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LANDFILL GAS ODOUR AND
UTILIZATION EVALUATION
UPPER OTTAWA STREET LANDFILL
SITE
HAMILTON, ONTARIO

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THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

**LANDFILL GAS ODOUR AND
UTILIZATION EVALUATION**

**UPPER OTTAWA STREET LANDFILL SITE
HAMILTON, ONTARIO**

**prepared for:
The Regional Municipality of
Hamilton - Wentworth**



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July 8, 1988

Reference No. 2239

Mr. R.J. Patrick
Director of Engineering Operations
Regional Municipality of Hamilton-Wentworth
Department of Engineering
71 Main Street West
Hamilton, Ontario
L8N 3T4

Dear Mr. Patrick:

Re: Design Report - Landfill Gas Odour Control and Utilization Evaluation
Upper Ottawa Street Landfill Site

Enclosed is a draft copy of the design report entitled "Landfill Gas Odour Control and Utilization Evaluation, Upper Ottawa Street Landfill Site". This report represents the completion of Phase I - Preliminary Design and Feasibility Testing for the landfill gas control system at the above noted site.

As of this date, Conestoga-Rovers & Associates has not received the test results from the trace gas analysis of the raw landfill gas samples taken from the site. The final report will be amended to incorporate this data and its evaluation. It is not expected that these results will substantially alter the report or the final conclusions and recommendations.

Should you have any questions regarding the enclosed or require additional information, please do not hesitate to contact us.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES



Anthony J. Crutcher, P. Eng.

JY/JO

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1.0 INTRODUCTION

On July 29, 1987, Conestoga-Rovers & Associates (CRA) received a revised request from the Regional Municipality of Hamilton-Wentworth (Region), for a proposal to provide engineering services to evaluate and subsequently implement a landfill gas collection and treatment system for the Upper Ottawa Street Landfill Site in Hamilton, Ontario. The above noted landfill site is located in the City of Hamilton as shown on Figure 1.1 and Figure 1.2.

A proposal entitled "Landfill Gas Collection and Treatment System, Upper Ottawa Street Landfill" was prepared by CRA and submitted to the Region on August 14, 1987. This proposal outlined a three phase program for the site evaluation, design and construction of an active landfill gas collection/treatment utilization system intended to control odour and atmospheric landfill gas emissions at the site. In December of 1987 CRA was authorized to proceed with this project as outlined in the proposal.

Work on the project commenced shortly after receipt of authorization. This report represents the completion of the first phase of the project, *Phase I - Preliminary Design and Feasibility Testing*. This design report presents background information outlining landfill gas generation theory, a description of the landfill gas probe and well installation at the



figure 1.1

LOCATION PLAN

UPPER OTTAWA STREET LANDFILL SITE
Regional Municipality of Hamilton - Wentworth

CRA



figure 1.2

SITE LOCATION
UPPER OTTAWA STREET LANDFILL SITE
Regional Municipality of Hamilton - Wentworth

Upper Ottawa Landfill Site, the results of the landfill gas pumping program, the landfill gas utilization options and a preliminary design for the gas collection system at the Upper Ottawa Street Landfill Site.

1.1 BACKGROUND

The Upper Ottawa Street landfill site operated from the early 1950's until closure in October of 1980. In addition to domestic and commercial waste, the landfill accepted both solid and liquid industrial waste. The landfill site is approximately 16 hectares in area with an estimated maximum refuse depth of 30 meters. The landfill site is bordered to the north by Red Hill Creek, to the east by the railway, to the south by Stone Church Road, to the south-west by a light industrial subdivision and to the west by the public works yard (Figure 1.2). Access to the landfill is by a service road from Upper Ottawa Street through a City Of Hamilton public works yard.

The air emissions from the Upper Ottawa Street Landfill Site have been a concern to the local citizens for the past several years. In May of 1986, the final report for the Upper Ottawa Street Landfill Site Study was released by the Study Committee appointed by the Ontario Ministry of Health. The Committee recommended that "an active landfill gas collection and flaring system be installed at the Upper Ottawa Street Landfill and that the

first phase of this work should begin as soon as possible". To achieve this goal a three phase study was initiated by the Region. This report represents the conclusion of the first phase of the study.

1.2 OBJECTIVES

The objectives of Phase I for the Landfill Gas Collection and Treatment System are identified as follows:

- a) To conduct a detailed pumping test of the landfill site to determine the quantity and quality of landfill gas that is being generated in the landfill site and to estimate the volume of gas which could be collected under an active landfill gas control system;
- b) To prepare a preliminary design and cost estimate for an active landfill gas control system; and
- c) To conduct a preliminary feasibility study to evaluate possible options for utilization of the landfill gas.

2.0 EXISTING CONDITIONS

Defining and understanding the existing conditions at a sanitary landfill site are essential elements in the evaluation of landfill gas generation. Landfill gas production is directly related to the type, age and moisture content of the refuse. Consequently, it is important to define the type and nature of the waste, when and where waste was placed, as well as, the leachate levels within the landfill mass.

2.1 REFUSE DISPOSAL

Refuse disposal at the Upper Ottawa Street Landfill Site began during the early 1950s, with closure of the site occurring in October of 1980. Characterization and quantities of the various types of wastes disposed of at the landfill site during its active life are hampered by the lack of records kept during its operation. The Upper Ottawa Street Landfill Study produced by the Study Committee in 1986 researched the site history. The subsequent section is a summary of the information contained in the above noted report which is pertinent to this landfill gas evaluation study.

The historical landfilling of the site was put together by the Committee with the aid of air photos. A summary of the landfilling progress is presented in Figure 2.1. In 1954, landfilling was restricted to a area on the western portion of the site. This area is shown as Area 1 on Figure 2.1 and is presently used as a storage area for the Public Works yard. During the period from 1954 to 1972, the majority of the areal landfill expansion occurred (Area 2,3 and 4 of Figure 2.1). The 1972 photos showed that landfilling was basically completed in Area 2, that landfilling was occurring adjacent to the railway tracks (Area 3) and that some landfilling had occurred along the southern boundary of the property (Area 4). From 1972 to closure the majority of the landfilling involved the additional filling of Areas 3 and 4 to final grade, as well as the expansion of the landfill further east along the railway tracks in Area 5. The method of landfilling is reported to have been by the progressive ramp method.

The types of waste that were accepted by the landfill during its operation consisted of residential and commercial waste, as well as both liquid and solid industrial wastes. As previously noted, the amount of wastes accepted is not known due to the lack of records. During 1977 a four month study was completed to estimate the total tonnage of waste entering the landfill. The study estimated that approximately 880,000 tons of waste were disposed of at the landfill during 1977. Although the status of the existing records make it impossible to accurately verify or refute the above noted tonnage, it is unlikely that this placement rate is correctly reported. The total refuse tonnage in place has been estimated at 1.5 million tons. Based on the uncertainty of the actual base grades of the landfill it can still be

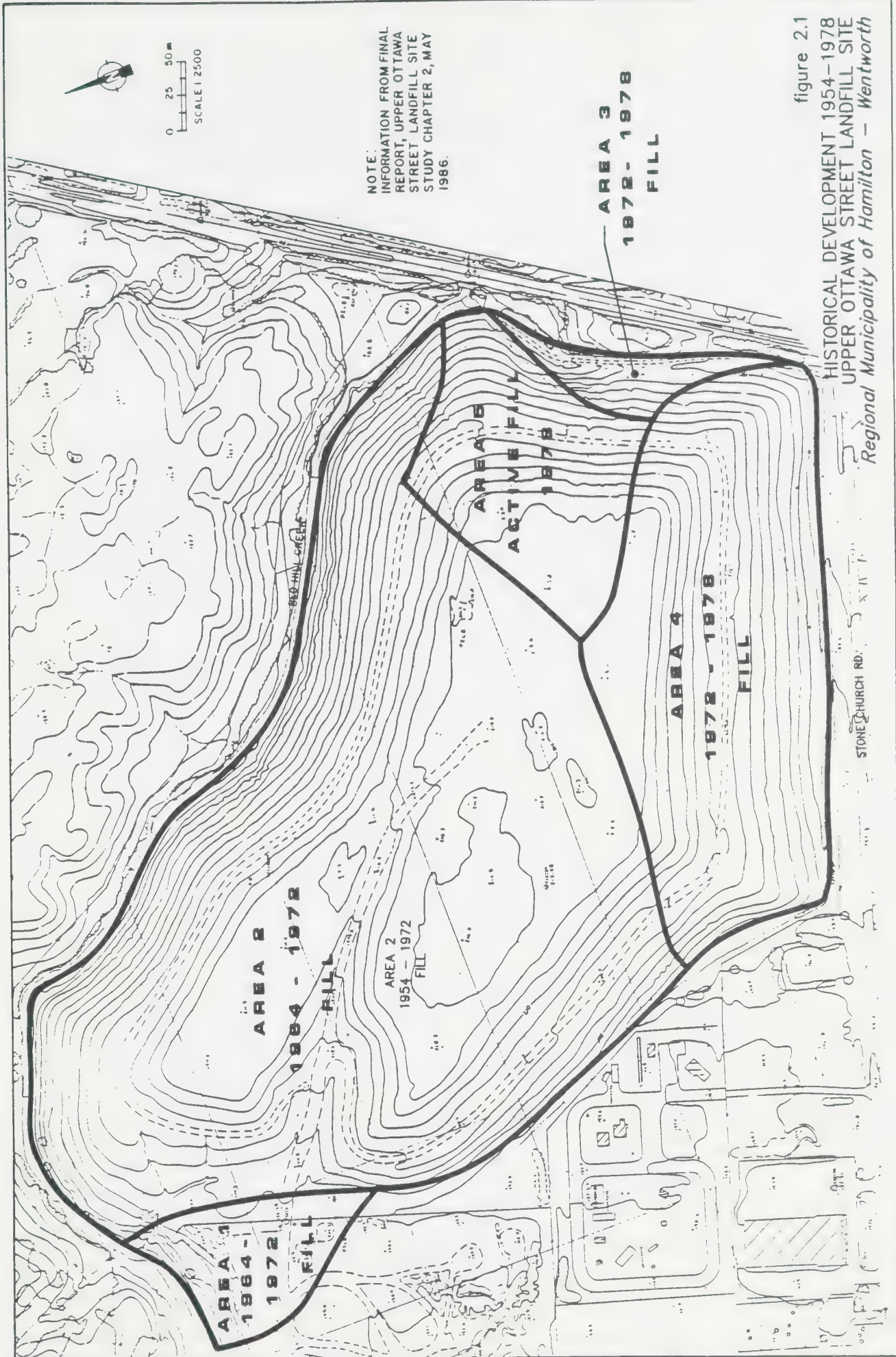


figure 2.1
HISTORICAL DEVELOPMENT 1954-1978
UPPER OTTAWA STREET LANDFILL SITE
Regional Municipality of Hamilton - Wentworth

assumed that the total maximum refuse in place does not exceed 2 million tons. It is unlikely that in excess of 40 percent of the entire in situ refuse volume was placed in 1977.

The amount of liquid industrial waste accepted at the site was estimated to be about one percent of the total waste disposed. The liquid waste was to be only from the Region. Two estimates of the amount of liquid waste are reported in the Committee report, these are 2.5 million litres in 1975 and 22 million litres in 1977. The increase in 1977 is attributed to the construction of a solidification/fixation plant that was constructed at the site in 1977. This plant was to have solidified the heavy metal sludges from the steel companies into inert fill. The plant was closed later due to questions and concerns regarding the solidification operation.

According to the Committee report, open burning at the site began around 1960. The burning of wood wastes was recommended by a consultants report to reduce the amount of subsidence that would occur during decomposition of the wood wastes. However, according to the Citizen's report, waste was also burned. The periodic (weekly) burning of wood and waste occurred alternately in the southeast and northeast corners of the site. Several times during the operation of the landfill site, uncontrolled fires occurred for several days. In 1977, the Ministry of the Environment (MOE) notified the Region that only clean wood could be burned during periods of certain specific atmospheric conditions and that the fire was to be

controlled and attended at all times. In November of 1978, the open burning of wood waste was halted by the Region at the landfill site.

The closure of the site in 1980 resulted in several major occurrences. The site was initially capped with approximately two million tons of steel industry waste as intermediate cover on the top and side slopes and then topped with a thin layer of clay material prior to hydroseeding. The intermediate and final cover materials range in thickness across the site. The intermediate material is in the range of 2.5 meters in thickness, while the clay cover material is in the range of 0.3 to 0.9 meters in thickness. A leachate toe drain system was installed along the east, south and west sides of the landfill site. The drain system is a gravity collection system that is pumped via a forcemain to a sanitary sewer on Stone Church Road. The collection pipe is connected to the upper slopes of the landfill with french drains. Along the north slope a 675 meter retaining wall was constructed to prevent erosion of the landfill by Red Hill Creek.

2.2 LEACHATE LEVELS

The leachate levels within the landfill site have been reported in two different studies (Gartner Lee and Institute of Groundwater Research). In each case the leachate levels were in the range of 186 to 188 m

AMSL. These levels reflect that the leachate mound within the site is of the order of 7 to 8 meters above the level of Red Hill Creek on the north side of the site and about 1 to 2 meters above the surrounding ground level on the south side of the site.

The Gartner Lee study predicted the leachate generation rate using the water balance method. Gartner Lee assumed that approximately 14 inches of the average yearly rainfall infiltrated into the refuse. Thus the average leachate generation rate for the site is 2.7 to 3.0 L/sec (35 to 40 gpm). This amounts to 83 to 95 million litres of leachate being generated annually. The Institute of Groundwater Research estimated the lateral hydraulic conductivity of the underlying fractured rock. The values reported estimate that the lateral flow to be in the range of 2.1 to 21 L/sec. The lateral flow represents a maximum value of leachate that could migrate from the site, but does not represent a generation rate. The value reported by Institute is for the lateral flow range for the shallow bedrock zone.

According to the results of the studies, the leachate levels appear to have remained constant since the capping of the site. These elevated leachate levels are anticipated to have enhanced the generation of landfill gas from the saturated zones in the site and thereby reduced the total gas generation life expectancy from these zones.

3.0 LANDFILL GAS GENERATION THEORY

The decomposition of organic materials contained in landfilled Municipal Solid Waste (MSW) results from a combination of biological, chemical, and physical processes. Methane gas however, is only produced through biological processes and thus biological processes are of primary importance in the generation of landfill gas. Interdependencies among the three processes require that chemical and physical processes also be considered.

Physical decomposition of MSW results from the breakdown or movement of the refuse components by physical degradation and by the rinsing and flushing action of water movement. Physical saturation of the refuse will result in the flow of dislodged refuse particles as a result of pressure gradients and diffusion as a result of concentration gradients. As the saturation level of the landfill increases, resulting in a high rate of water movement, increased amounts of refuse particles will be dislodged resulting in a more chemically homogeneous refuse mass. This generally results in higher rates of landfill gas generation.

Chemical processes resulting in MSW decomposition include the hydrolysis, dissolution/precipitation, sorption/desorption and ion exchange of refuse components. Chemical decomposition generally

results in altered characteristics and greater mobility of refuse components thereby enhancing the rate at which the landfill becomes more uniform chemically. The end result of chemical decomposition is that the optimal biological conditions necessary for landfill gas to be generated are attained more quickly. Thus, chemical decomposition serves to aid biological gas generation.

Physical and chemical decomposition of refuse materials play an important part in landfill stabilization. However, biological decomposition is the most important process in refuse decomposition and the only process to produce methane gas.

Biological decomposition is a complex process at landfill sites, consisting of various biologically mediated sequential and parallel pathways by which refuse is decomposed completely or partially to various end products. Landfill gas generation results from a number of biological processes that are initiated during refuse generation, collection and placement in a landfill.

Biological decomposition takes place in three stages. Each stage has its own environmental and substrate requirements which result in characteristic end products and effects produced. The first stage takes place when refuse is initially placed in the landfill and some oxygen within the refuse invariably exists. During this stage aerobic micro-organisms degrade

organic materials to carbon dioxide, water, partially degraded residual organics and heat. Aerobic decomposition is characteristically rapid relative to subsequent anaerobic states of decomposition because the available oxygen within the refuse mass is readily depleted. The aerobic micro-organisms produce carbon dioxide levels as high as 90 percent and temperature increases to as high as 40°C. The elevated carbon dioxide results in the formation of carbonic acid in the refuse, thus resulting in acidic pH levels.

The second stage of refuse decomposition involves the facultative micro-organisms which become dominant as the oxygen is depleted. The facultative micro-organisms continue the decomposition process with characteristic end products being high levels of carbon dioxide, partially degraded organics and little production of heat. The production of carbon dioxide and organic acids results in the lowering of the pH of any available moisture, in turn resulting in the dissolution of other organics and inorganics.

After all of the oxygen has been depleted the third stage of refuse decomposition involving the anaerobic methanogenic bacteria becomes dominant. These organisms produce carbon dioxide, methane and water with little production of heat. Characteristically, these organisms work relatively slowly but efficiently over many years to decompose the remaining organics.

Landfills actively receiving refuse will normally undergo all three of these decomposition processes simultaneously. However, typically within the first couple of years following landfill closure the anaerobic stage becomes dominant and remains as such until all the remaining organics have been decomposed. ~~Thus, as the landfill ages, the~~
~~amount of gas generated gradually decreases over time.~~ The total amount of landfill gas to be generated will essentially depend upon the organic content of the refuse as placed and to some extent on various parameters which control landfill gas generation rates. The rate at which landfill gas is generated depends upon many factors which will subsequently be discussed in Section 3.2.

3.1 THEORETICAL TOTAL LANDFILL GAS PRODUCTION

The total amount of landfill gas to be generated from a unit mass of refuse is dependent on the organic content of the refuse and to some extent on the environmental conditions developed for the methanogenic micro-organisms. Generally however, large municipal landfills are characterized by a relatively uniform refuse composition. Therefore, an extensive literature review was undertaken to determine the range of expected total landfill gas yield. Table 3.1 presents a listing of some of the gas yields (cf/lb) determined by various researchers. It is immediately obvious upon review of Table 3.1 that the various researchers have presented a large

TABLE 3.1
TOTAL LANDFILL GAS GENERATION

Reference Number	Title	Author(s)	Date	Values Presented ft ³ /lb	Conditions
	Controlled Landfill Methane Project	John G. Pacey EMCON Associates	6th International Landfill Gas Symposium March 1983	Average 0.30 to 0.54 ft ³ /lb (ft ³ of landfill Gas per pound of refuse over 20 months)	Six test cells with various water content and sludge additions. (All values normalized on the basis of a unit weight of dry refuse)
	Recovery, Processing and Utilization of Gas from Sanitary Landfills	Lockman & Associates Prepared for Municipal Environmental Research Lab - Cincinnati, Ohio. Also, Predicting Gas Generation from Landfills Robert K. Ham	February 1979	Results from Several Authors Presented Total Landfill Gas Anderson & Calliman Theoretical 6.56 Boyle Theoretical 7.21 Golueke Theoretical 4.80 Pacey Theoretical 1.92 Klein 3.84 Hitte 3.36 Pfeffer 4.16 Schwegler 3.04 Hekimian 0.8 Alpern 8.48 City of Los Angeles 6.24 Bowerman et al 6.40 Blanchet 2.08	Typical Municipal Refuse Typical Municipal Refuse Determined Volatile Component of Refuse Determined Degradability of Organic Components Lab Measurement Digested With Sewage Sludge Lab Measurement Lab Measurement Estimated Estimated Theoretical/Measurements in Landfills Theoretical Measurement/Theoretical

continued....

TABLE 3.1
TOTAL LANDFILL GAS GENERATION

Reference Number	Title	Author(s)	Date	Values Presented ft ³ /lb	Conditions
				VTN Consolidated for	Estimate
				L.A. Landfills 0.8	Measurement
				Mery 0.21	(Small Lysimeters)
				Mery & Stone 0.064	Measurement (Lysimeter)
				Rovers & Farquhar 0.048	Measurement (Lysimeter)
				Streng 0.62	Measurement (Lysimeter)
				Chian 0.008	Measurement
					(Small Lysimeter)
				Results from Several	
	State of the Art of	EMCON Associates	June 1981	Authors Presented	
	Methane Gas			Alpern' 6.8	Stoichiometric
	Enhancement in			Leckie 8.0	Stoichiometric
	Landfills			Dair & Schwegler 3.0	Biodegradability
				Golueke 5.6	Biodegradability
				Pfeffer 4.0	Biodegradability/ Theoretical

range of gas yields from refuse. It must be noted that these data represent unique sets of conditions and specific experimental methods. It was therefore necessary to determine which of the data reviewed were applicable to the conditions at the Upper Ottawa Street Landfill Site.

Theoretical gas yields based on stoichiometric and biodegradability relationships generally indicated that approximately 3.0 to 8.0 cubic feet of landfill gas are produced from one pound of typical refuse. Variations in the theoretical gas yields presented in the literature are due primarily to waste compositional differences. Experimental gas yield determinations using small scale lysimeters generally indicate a smaller volume of landfill gas will be produced. The applicability of these data are suspect because of the difficulty in simulating actual landfill conditions and climatic events on a small scale. Many of the studies which were intended to produce gas generation data are inconclusive because methane gas generation was never achieved.

Estimation of the total gas generation levels have been approached from both the theoretical and field-related experiences. Dr. Robert Ham of the University of Wisconsin-Madison has been very active in this type of problem. His approach has been developed at three levels:

- (i) a theoretical volume of gas produced per pound of decomposed matter, using stoichiometric relationships:

- (ii) a more refined model, taking into account cell synthesis, suggests production on the order of 4 cf CH₄/lb matter decomposed (or 8 cf total gas/lb matter decomposed); and
- (iii) from this, he has then indicated that practical maximum production is likely much less - ranging from 25 to 75 percent of that given in (ii).

Dr. Ham supports a range of 1 to 3 cf of total gas/lb of matter decomposed, with the higher value being obtained when conditions are close to optimal for methane production. In locations such as California, conditions are not optimal and therefore, there is an initial period of production and also a lengthy period of production in the latter periods of decomposition, for which economic recovery is not likely, thus, in some climates, the tendency would be to tend toward the lower end of the range.

Landfill gas collection designs generally utilize conservative estimates of *Total Gas Production*. In other words, they try to design with flexibility and caution, to ensure that production levels will be attainable. In addition many researchers do not report the actual Total Gas Production, but rather the practical *Total Gas Recoverable*.

The information from the technical literature reduces the amount of methane because of the nonrecoverable nature of some of the methane (it is noneconomic for gas recovery during the initial and the final stages of production and there are some boundary effects). In balance, it is likely that the design of the Upper Ottawa Street system should be able to approach the upper range of the total gas production levels [$3.0 \pm \text{cf (gas)/lb (refuse)}$] presented in the technical literature as the design discounts the potentially non-recoverable gas and defines a net mass of waste for estimating recoverable landfill gas.

3.2 THEORETICAL LANDFILL GAS GENERATION RATES

Landfill gas generation rates typically vary depending upon the anaerobic environment available to the methanogenic microorganisms. Conditions affecting landfill gas generation rates include:

1. Refuse composition;
2. Age of refuse;
3. Moisture content;
4. pH;
5. Microbial population present;
6. Temperature;
7. Quantity and quality of nutrients; and

8. Other environmental factors;

Refuse composition affects the gas generation rate for municipal landfill sites. However, it is generally considered that gas generation rates at large municipal landfill sites are not strongly affected by refuse composition since these sites are characterized by somewhat uniform refuse composition. In cases where the refuse composition is non-uniform, then the gas generation rates would be adjusted to account for the differences in biodegradability of the waste. For the Upper Ottawa Street Landfill Site the waste is assumed to be consistent with other municipal landfill sites (recognizing that the site did receive liquid industrial waste) since further refuse composition information is lacking for the site. Table 3.2 presents selected gas generation rates (cf/lb/yr) for landfills subject to various environmental conditions as presented by various landfill gas researchers.

Moisture content is considered to be the most important of the parameters controlling gas generation rates. The methanogenic bacteria require a minimum subsistence moisture level which is provided by even the driest of landfills. As the moisture level increases and approaches field capacity the gas generation rates are only moderately increased. This is because flow through of water only occurs as the moisture level exceeds field capacity and therefore nutrients, alkalinity, pH, bacteria etc., are not readily transferred throughout the landfill before field capacity has been achieved. After the moisture level exceeds field capacity a flow through of liquid carrying nutrients, alkalinity, pH and bacteria occurs

TABLE 3.2
LANDFILL GAS GENERATION RATES

[illegible]

continued...

TABLE 3.2
LANDFILL GAS GENERATION RATES

Reference Number	Title	Author(s)	Date	Values Presented ft ³ /lb/yr	Conditions
	Results of the Mountain View Controlled Landfill Project	EMCON Associates	February 1987	0.25 to 0.6	Six Test Cells
	State of the Art of Methane Gas Enhancement in Landfills	EMCON Associates	June 1981	Results from Several Authors Presented Augenstein 4.2 Buivid 0 - 13 Chian et al 0.00096 to 0.069 Moell 0.022 to 0.056 Pohland 0.000013 Walsh and Kinman 0.0019 Bradley Landfill 0.080 Inland Cement Landfill 0.045 Scholl Canyon 0.046 Ascon Landfill 0.070 Azuza-Western 0.043 Mountain View Landfill 0.077 Sheldon Arieta L.F. 0.120 Hewitt Landfill 0.092 Penrose Landfill 0.079	Lysimeter Lysimeter Lysimeter Simulated Landfill Simulated Landfill Simulated Landfill Field Test Field Test Field Test Recovery Recovery Recovery Recovery Gas Control Gas Control Six test cells with various water content and sludge additions
	Controlled Landfill Methane Project	John G. Pacey EMCON Associates	6th International Landfill Gas Symposium	0.1 to 0.48 ft ³ /lb/yr over the test period	
	WMI Florida Pompano Beach	WMI	February 1987	0.37	"Wet" Landfill

which serves to greatly enhance the landfill gas generation rates. The landfill gas generation rates will increase to the maximum levels as 100 percent saturation of the refuse has been achieved. The Upper Ottawa Street Landfill Site is characteristically very wet and therefore variable gas generation rates are applicable to refuse zones with variable moisture levels. The implications of the appreciable leachate head at the Site were previously identified in Section 2.2.

The quantity and quality of nutrients available to the methanogenic bacteria will also be a significant factor affecting gas generation rates. The principal nutrients required by the methanogenic bacteria include: carbon, hydrogen, oxygen, nitrogen and phosphorous. These nutrients must be in the solid or liquid phase and do not include the free air component. In addition to these essential nutrients, the bacterial cells require limited concentrations of trace elements such as: sodium, potassium, calcium and magnesium. In the literature reviewed, it was evident that application of sewage sludge to the refuse provides these needed nutrients. Experimental studies also show that sewage sludge application, which contains a population of methanogenic bacteria, will enhance the establishment of a suitable bacterial population.

Environmental factors such as pH and temperature also have significant effects on landfill gas generation rates. Methanogenic bacteria require a pH in a narrow range of between 6.7 and 7.2 for optimal gas generation to be achieved. Leachate quality data presented in the monitoring

results report prepared by Trow indicated that the pH of the leachate has remained within the "window" of optimal gas generation, therefore indicating gas generation at the Site has not been affected by adverse pH conditions. Temperature has also been found to significantly impact upon landfill gas generation rates. Experimental evidence indicates that by an increase in the temperature of 10°C the rate of bacterial growth may be essentially doubled. In landfill environments temperatures generally range in the 20°C to 60°C range with 43°C being optimal for gas production. Temperature data from the Site indicate that the refuse mass temperature (40 °C ±) is essentially at the optimal gas generating temperature. This effect is especially prevalent within the saturated refuse.

After reviewing the available literature and consulting with researchers in landfill gas generation it was concluded that the following gas generation rates were applicable to the unsaturated and saturated refuse at the Upper Ottawa Street Landfill Site.

<u>Zone</u>	<u>Range (cf/lb/yr)</u>	<u>Range (m³/kg/yr)</u>
Unsaturated	0.1 to 0.2	0.006 to 0.013
Saturated	0.4 to 0.6	0.025 to 0.037

The above-noted rates will be utilized in the estimation of the of the remaining lifespan of gas production in the landfill site and will serve as a check on the validity of the results obtained during the pumping test.

4.0 GAS WELL AND MONITORING PROBE INSTALLATION

The gas wells and gas probe nests for the odour control and gas recovery testing programs were installed at the Upper Ottawa Street Landfill Site from February 25, 1988 to March 4, 1988. The odour control test system located on the Stone Church Road side of the site consisted of three shallow gas wells (GW1-88 to GW3-88) and nine gas probe nests (GP1-88 to GP9-88). The gas recovery system located on the Red Hill Creek side of the site adjacent to the railroad tracks consisted of one deep gas well (GW4-88) and seven gas probe nests (GP10-88 to GP16-88). The locations of the gas wells and the probe nests are presented on Plan 1 (enclosed).

The odour control wells were spaced approximately 30 meters apart at the apexes of a triangle. The gas probe nests were spaced approximately 7.5 meters apart along the base of the triangle, the altitude of the triangle and also extending towards the west for approximately 30 meters. All of the gas wells and probe nests were installed perpendicular to the side slope of the landfill site.

The odour control gas wells were constructed of 75 mm diameter Schedule 40 PVC pipe with the screened section perforated by 6.5 mm diameter holes. The wells were installed in 280 mm diameter augered holes with the well screen placed below the landfills cover material (steel

industry waste). The void space around the screen was backfilled with pea gravel which was sealed from the surface by a bentonite seal. The remaining portion of the borehole was filled with excavated material. Figure 4.1 presents the instrumentation details for gas well GW1-88. Details of all gas wells installed are presented in Appendix A.

The gas probe nests for the odour control system were constructed of 13 mm diameter Schedule 40 PVC pipe with the screened section perforated by 3 mm diameter holes. The probes nests were installed in 200 mm diameter boreholes with the screened sections backfilled with pea gravel. The individual screened sections were sealed with a bentonite seal. The deep probes (A) were set at approximately 6 meters below the ground surface while the shallow probes (B) were set with the screened section in the center of the landfill cap. As an example of the gas probes installed, Figure 4.2 presents the details of GP1-88. Instrumentation details for all gas probes are presented in Appendix A.

The landfill gas utilization well (GW4-88) was constructed of 100 mm diameter Schedule 40 PVC pipe with the screened section perforated by 6.5 mm diameter holes. The well was installed in a 280 mm diameter augered borehole. The screened portion of the well was from approximately 5.5 meters to 15.4 meters below grade. The void space surrounding the screen was backfilled with pea gravel and a bentonite seal placed on top of the pea gravel. The remainder of the borehole was filled with the auger cuttings.

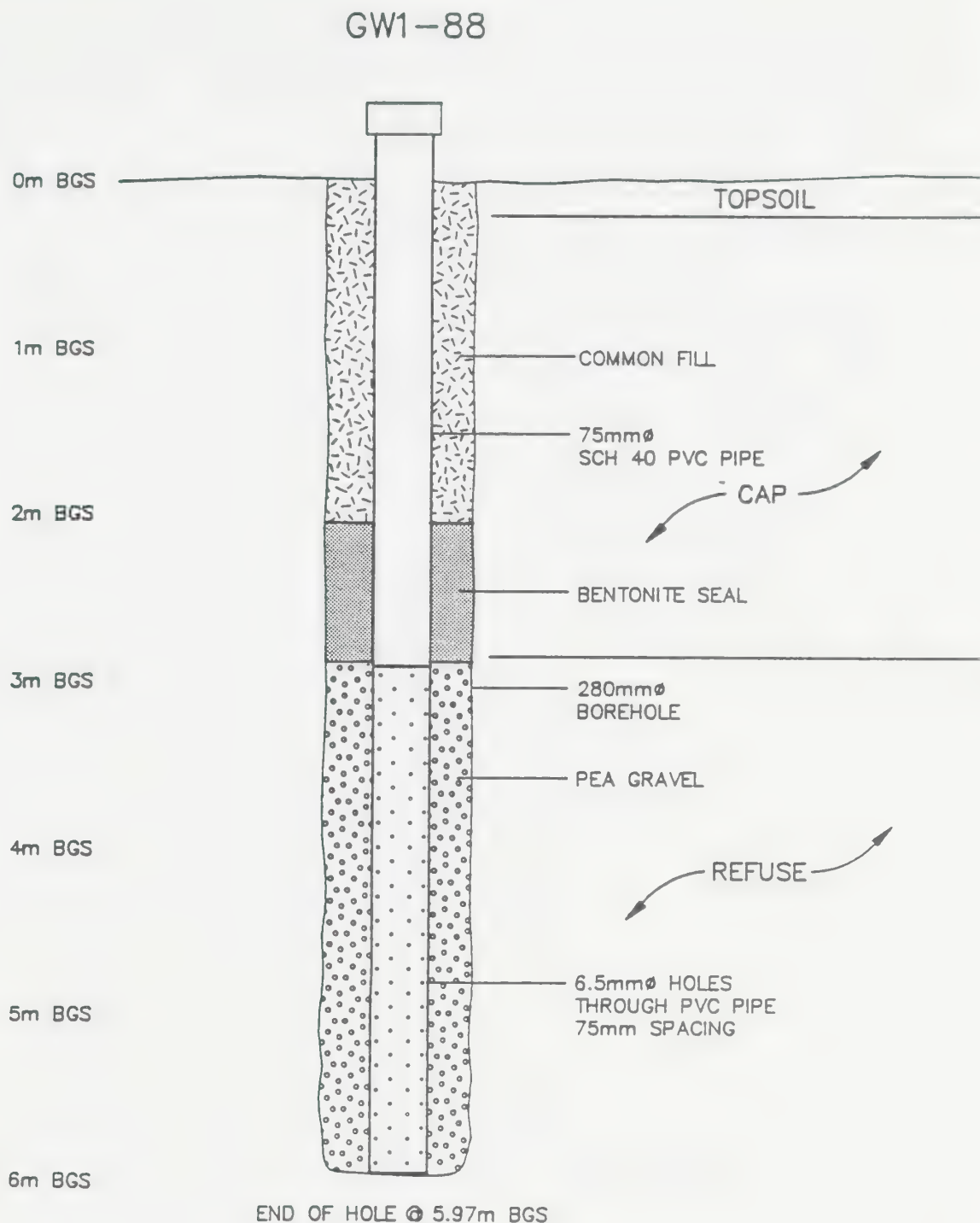


figure 4.1

GW1-88 — INSTRUMENTATION DETAIL
 UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton — Wentworth

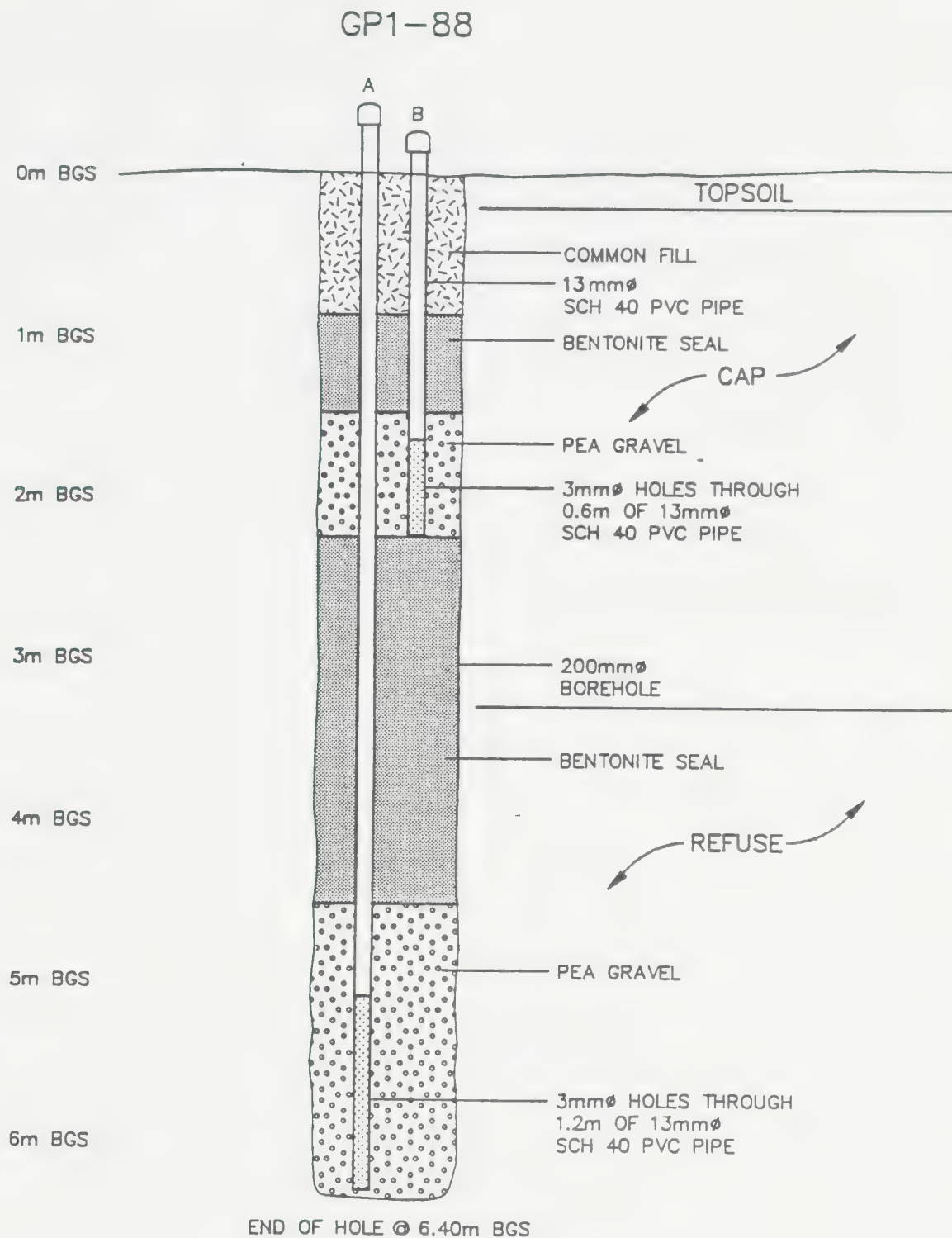


figure 4.2

GP1-88 - INSTRUMENTATION DETAIL
 UPPER OTTAWA STREET LANDFILL GAS
 Regional Municipality of Hamilton - Wentworth

The gas probe nests for the utilization system were constructed in a similar manner to the odour control system (Figure 4.2), except that three probes were installed in each nest. The deep (A) and intermediate (B) probes were installed at various depths according to the conditions encountered during drilling. The shallow (C) probes were installed at the base of the landfill cap. The exception to the probe installation details is GP11-88. This probe nest contains 6 gas probes. The three deepest probes (A, B and C) were installed in what appeared to a perched water table, but after several days of observation, the probes were considered to be below the leachate level and were replaced with 2 additional probes at a high elevation.

Table 4.1 summarizes the gas well and gas probe installation details. The table presents the ground surface elevation, the screened interval and the dimensions of the screen.

During the installation of the gas utilization system an oily material was encountered at depth during the installation of GP11-88 and GP12-88. This area may have been the location of one of the old industrial waste ponds that were present at the site during its active stage.

TABLE 4.1
GAS WELL AND GAS PROBE INSTALLATION SUMMARY

Probe/Well Designation	Date Completed	Ground Elevation (m AMSL)	Screened Interval		Screen Length (m)	Screen Details
			Depth (m bgs)	Elevation (m AMSL)		
Odour Control System						
GW1-88	Feb28/88	204.2	2.9 - 6.0	201.3 - 198.2	3.1	76 mm Ø perf. PVC pipe, no filter cloth
GW2-88	Feb28/88	205.9	3.0 - 6.0	202.9 - 199.9	3.0	76 mm Ø perf. PVC pipe, no filter cloth
GW3-88	Feb28/88	213.0	3.2 - 6.2	209.8 - 206.8	3.0	76 mm Ø perf. PVC pipe, no filter cloth
GP1A-88	Feb24/88	204.2	5.1 - 6.3	199.1 - 197.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP1B-88	Feb24/88	204.2	1.7 - 2.3	202.5 - 201.9	0.6	13 mm Ø perf. PVC pipe, no filter cloth
GP2A-88	Feb24/88	204.1	5.0 - 6.2	199.1 - 197.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP2B-88	Feb24/88	204.1	1.4 - 2.0	202.7 - 202.1	0.6	13 mm Ø perf. PVC pipe, no filter cloth
GP3A-88	Feb24/88	204.0	4.9 - 6.1	199.1 - 197.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP3B-88	Feb24/88	204.0	0.9 - 2.1	203.1 - 201.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP4A-88	Feb24/88	204.0	4.9 - 6.1	199.1 - 197.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP4B-88	Feb24/88	204.0	0.9 - 2.1	203.1 - 201.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP5A-88	Feb25/88	204.5	4.9 - 6.1	199.6 - 198.4	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP5B-88	Feb25/88	204.5	0.9 - 2.1	203.6 - 202.4	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP6A-88	Feb25/88	205.0	5.0 - 6.2	200.0 - 198.8	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP6B-88	Feb25/88	205.0	1.1 - 2.3	203.9 - 202.7	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP7A-88	Feb25/88	205.8	4.8 - 6.0	201.0 - 199.8	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP7B-88	Feb25/88	205.8	1.3 - 2.5	204.5 - 203.3	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP8A-88	Feb25/88	208.0	4.9 - 6.1	203.1 - 201.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP8B-88	Feb25/88	208.0	0.9 - 2.1	207.1 - 205.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP9A-88	Feb25/88	210.6	4.9 - 6.1	205.7 - 204.5	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP9B-88	Feb25/88	210.6	0.9 - 2.1	209.7 - 208.5	1.2	13 mm Ø perf. PVC pipe, no filter cloth

continued ...

TABLE 4.1
GAS WELL AND GAS PROBE INSTALLATION SUMMARY

Probe/Well Designation	Date Completed	Ground Elevation (m AMSL)	Screened Interval		Screen Length (m)	Screen Details
			Depth (m bgs)	Elevation (m AMSL)		
Utilization System						
GW4-88	Feb29/88	205.5	5.2 - 15.4	200.3 - 190.1	10.2	102 mm Ø perf. PVC pipe, no filter cloth
GP10A-88	Mar2/88	205.0	8.8 - 10.0	196.2 - 195.0	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP10B-88	Mar2/88	205.0	6.3 - 7.5	198.7 - 197.5	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP10C-88	Mar2/88	205.0	1.6 - 2.8	203.4 - 202.2	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP11A-88	Feb25/88	205.3	20.3 - 21.5	185.0 - 183.8	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP11B-88	Feb25/88	205.3	17.1 - 18.3	188.2 - 187.0	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP11C-88	Feb25/88	205.3	9.8 - 11.1	195.5 - 194.2	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP11D-88	Feb25/88	205.3	1.4 - 2.6	203.9 - 202.7	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP11E-88	Mar2/88	205.3	8.1 - 8.4	197.2 - 196.9	0.3	13 mm Ø perf. PVC/polypropylene filter cloth
GP11F-88	Mar2/88	205.3	5.8 - 6.1	199.5 - 199.2	0.3	13 mm Ø perf. PVC/polypropylene filter cloth
GP12A-88	Mar1/88	205.5	9.4 - 10.7	196.1 - 194.8	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP12B-88	Mar1/88	205.5	6.4 - 7.7	199.1 - 197.8	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP12C-88	Mar1/88	205.5	3.7 - 4.9	201.8 - 200.6	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP13A-88	Mar1/88	205.6	8.9 - 10.1	196.7 - 195.5	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP13B-88	Mar1/88	205.6	5.9 - 7.2	199.7 - 198.4	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP13C-88	Mar1/88	205.6	3.6 - 4.8	202.0 - 200.8	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP14A-88	Mar1/88	205.8	9.1 - 10.7	196.7 - 195.1	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP14B-88	Mar1/88	205.8	6.4 - 7.7	199.4 - 198.1	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP14C-88	Mar1/88	205.8	3.4 - 4.6	202.4 - 201.2	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP15A-88	Feb29/88	205.8	11.1 - 12.3	194.7 - 193.5	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP15B-88	Feb29/88	205.8	6.6 - 7.9	199.2 - 197.9	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP15C-88	Feb29/88	205.8	3.1 - 4.4	202.7 - 201.4	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP16A-88	Feb27/88	205.8	12.5 - 13.7	193.3 - 192.1	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP16B-88	Feb27/88	205.8	6.4 - 7.6	199.4 - 198.2	1.2	13 mm Ø perf. PVC pipe, no filter cloth
GP16C-88	Feb27/88	205.8	2.2 - 3.4	203.6 - 202.4	1.2	13 mm Ø perf. PVC pipe, no filter cloth

5.0 LANDFILL GAS PUMPING PROGRAM

During the latter part of February and the earlier part of March 1988, CRA installed a dual temporary landfill gas pumping system at the Upper Ottawa Street Landfill Site. The dual pumping system was set-up to evaluate the effects of pumping the landfill gas with two different types of wells (shallow versus deep) and to determine the flow rates which would be used as the basis for the design of the odour control and gas recovery system.

The commencement of the test program was governed by the issuance of a temporary Certificate of Approval (Air) for the operation of a landfill gas flare to burn the gases collected during the test program. The Ministry of the Environment issued the necessary approval on May 6, 1988.

The gas pumping test commenced on May 9, 1988 with the activation of the two pumping systems. The testing program was completed on June 16, 1988 with the collection of gas samples for the trace gas analysis.

5.1 PUMPING SYSTEM EQUIPMENT SET-UP

Figure 5.1 schematically illustrates the set-up for the gas test pumping systems. The odour control and utilization systems were controlled independently using separate gas pumps and piping systems. The two systems shared a common discharge pipeline and gas flare to burn the landfill gas which was extracted during the pumping test.

Landfill gas was pumped from the odour control wells via an above ground 75 mm Ø PVC pipeline using a Roots XA 24 gas pump. The gas flow rate from the odour wells was individually controlled at each well using 50 mm diaphragm valves. The gas from the utilization system was pumped across the landfill site above ground in a 100 mm Ø PVC pipeline using a Roots XA 47 gas pump. The flow from the deep well was controlled by a 75 mm diaphragm valve that was located upstream of the gas pump. The operating flow range of pumps was varied by exchanging the pulley sizes of the Roots pumps and fine tuning the flow rates by controlling the head loss at the valves.

The discharge flow from the gas pumps was routed to a common 150 mm Ø PVC exhaust line which was connected to a 250 mm Ø horizontally mounted flame arrestor. The flame arrestor was connected to a

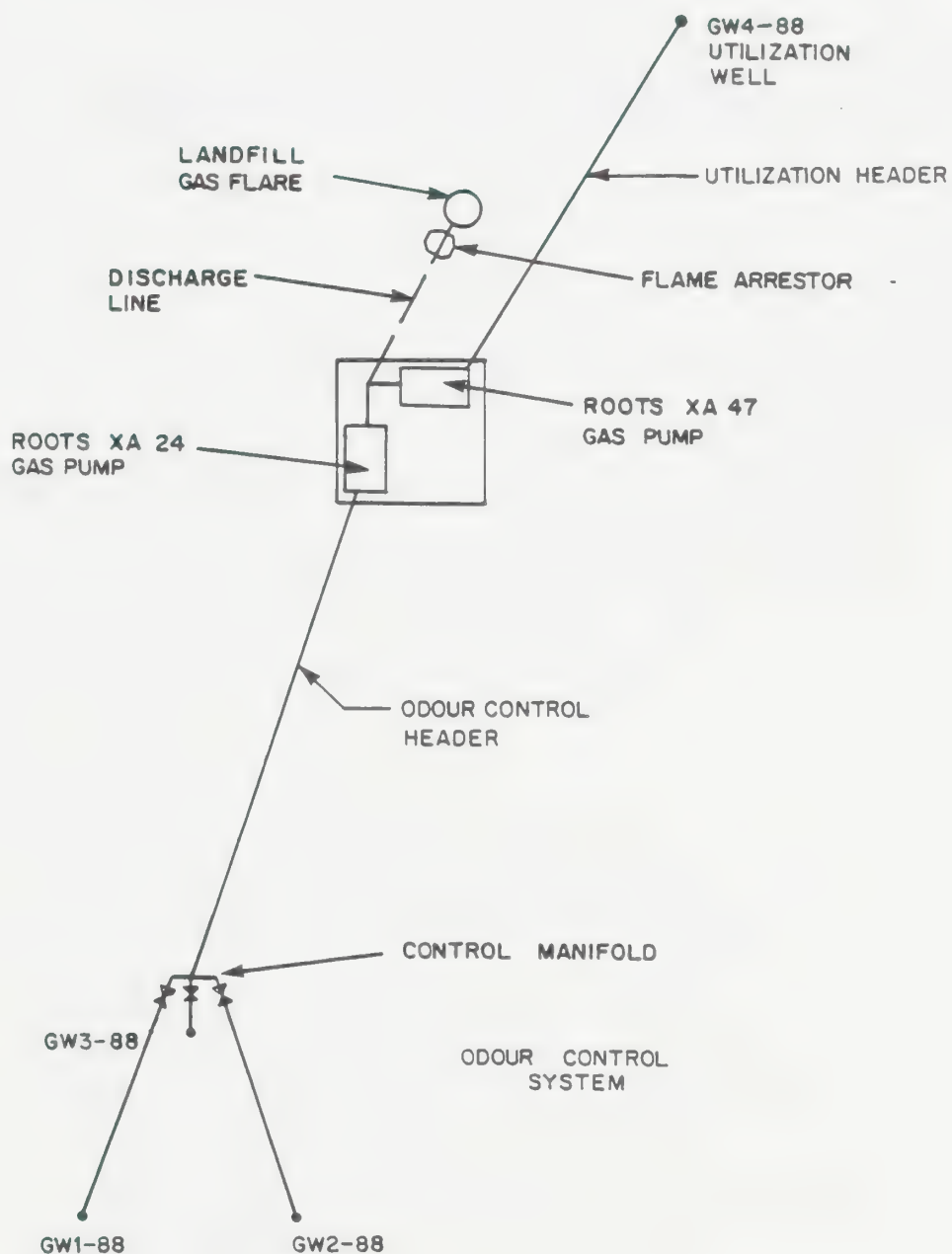


figure 5.1
PUMPING TEST SCHEMATIC
UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton – Wentworth

gas flare so that the landfill gas could be flared on a temporary basis during the test program.

5.2 MONITORING AND GAS COLLECTION PROCEDURES

To assess the effects of gas pumping on the landfill site under landfill gas odour control and utilization scenarios and in order to monitor the operation of the pumping system, 48 locations were selectively monitored for static pressure, combustible gas concentration and gas temperature. The monitoring locations for the two systems consisted of the following:

Odour Control System

- 9 gas probe nests of 2 probes each at various depths (18 probes)
- 1 sampling port on pipeline to individual well (3 ports)
- 1 sampling port on the common header to the blower
- 1 pitot tube measurement point on the common header to the blower

Utilization System

- 6 gas probe nests of 3 probes each, and 1 nest of 6 gas probes at various depths (24 gas probes)

- 2 on-line sampling ports
- 1 on-line pitot tube measurement point

In addition to the above, a sampling port was attached to the common 150 mm Ø positive pressure discharge pipeline to the gas flare.

The data collected thrice weekly consisted of the gauge pressure and methane gas concentration from each of the gas probes and the well head sampling ports, as well as the pressure differential for each of the pitot tube sampling locations. The barometric pressure and atmospheric temperature were collected from the Mount Hope Airport on a weekly basis. In addition, temperature was measured on an occasional basis in the gas probes.

Gas pressures and pitot tube measurements were measured with a Dwyer magnehelic differential pressure gauge. The combustible gas concentrations were measured with a MSA Model 60 Combustible Gas Scope Indicator calibrated with a gas containing 48.5 % methane by volume and the remainder as carbon dioxide, nitrogen, hydrogen and oxygen. Temperatures observed at the gas probe screens were monitored using a thermocouple temperature gauge with digital readout.

Two sets of landfill gas samples were collected from each of the sampling ports on the main lines for each system. The initial set of samples were collected to confirm the percent of methane within the gas being extracted from the landfill and to determine the relative percentages of nitrogen, oxygen and carbon dioxide within the gas. The second set of samples were collected to determine the trace gas constituents that were in the gas. The first set of samples were analyzed by the University of Waterloo Earth Sciences Laboratory while the second set of samples were analyzed by Mann Testing Inc. The results of the gas analysis will be presented in Section 6.3 of this report.

5.3 PUMPING TEST

The pumping test program conducted consisted of two distinct programs, the odour control program and the utilization program. Both programs were controlled independently with regard to pumping rates and system operation. Thus, the analysis and evaluation of each pumping system will be discussed separately in the subsequent sections.

5.3.1 Odour Control System

The odour control system was operated with a Roots XA 24 gas pump for the period of May 9, 1988 to June 20, 1988. During this time period the system was continuously operational except for approximately a 24-hour period, due to power interruption and several short periods for flow rate adjustments (pulleys changed).

The pumping test program for the odour control system was set-up to determine the the following items;

- a) The landfill gas generation rate on the Stone Church Road side for the landfill site;
- b) The influence of continuous landfill gas extraction on the gas concentrations within the cover material; and
- c) The zone of influence of production wells for this portion of the site.

To achieve these objectives the odour control system was operated on an almost continuous basis and at several different flow rates during routine monitoring of the nested landfill gas probes in the area. The gas probes in the area were monitored as previously detailed in Section 5.2.

The odour control system was operated at four different flow rates during the study period. The flow rates were 0.18, 0.30, 0.46 and 0.63 m³/min (6.2, 10.7, 16.3 and 22.2 cfm) for the respective time periods; May 9 to May 18, May 18 to May 25, May 25 to June 1, June 1 to June 20, 1988. During operation of the system, minor fluctuations in the flow occurred for various reasons. Some of the possible flow variation occurred as a result of condensate build-up in the pipelines and rapid changes in atmospheric conditions at the site.

No major problems occurred during the operation of the system. Minor problems with condensate build-up did occur in the vicinity of the control valves. However, this problem was corrected with minor adjustments to the above ground pumping system.

Discussion on the results of the odour control system pumping test are presented in Section 6.0 of this report.

5.3.2 Utilization System

The landfill gas utilization system was operated with a Roots XA 47 gas pump for the period from May 9, 1988 to June 20, 1988. During this time period the pumping system was continuously operational except for approximately a 24-hour period on May 19 to 20, 1988 (due to power interruption), for a second period of unknown length on May 24-25, 1988 (due to breakage of the collection pipe) and for several short periods during changes of the pulley to vary the flow rate.

The pumping test program to evaluate the gas utilization potential of the site was set-up to determine the gas recovery rate and collection efficiency (zone of influence) using a deeper gas wells. To determine the above, the gas probes were monitored (as per Section 5.2) on a routine basis under different pumping conditions. The utilization system was operated at the flow rates of 1.4, 1.7, and 1.0 m³/min (50, 60 and 36 cfm) for the respective time periods, May 9 to May 24, May 24 to May 27 and May 27 to June 20 1988. During the May 9 to May 24 period the flow was reduced twice to 1.1 m³/min (40 cfm) due to low methane concentrations in the extracted gas.

The test program for the utilization system was hampered throughout by fluctuating flow rate problems and high vacuum pressures at

the well head. The fluctuating flow rates for the well system were not caused by problems in the piping system or condensate build-up but rather appeared to be a result of the landfill condition around the production well. The high vacuum pressures were a result of the well location and the physical characteristics of the landfill around the well.

Detailed discussion of the results of the utilization system pumping test are presented in Section 6.0 of this report. -

6.0 PUMPING TEST RESULTS

The landfill gas pumping test information collected over the May 9, 1988 to June 20, 1988 time period are presented in Appendix B and C for the odour control system and the utilization system respectively. A summary of the weather information obtained from the Atmospheric Services branch of Environment Canada for the Mount Hope Airport are presented in Appendix D.

The results of the individual pumping tests are discussed in detail in the subsequent sections.

6.1 ODOUR CONTROL SYSTEM

6.1.1 Landfill Gas Pressures and Quality

The static landfill gas pressures that were collected prior to startup of the pumping system indicated that the pressures varied in both the spatial and temporal domain. The static pressure results for April 7, 1988 were collected during a test burn of the system and reflect the probe pressure under

a pumping condition. The spatial variations of the static pressure readings appeared in both the vertical and horizontal directions. The spatial variations noted at the landfill site are attributed to the different landfill gas generation rates within the site and the physical characteristics of the site. The temporal pressure variations at the site are attributed to changes in barometric pressure from monitoring event to monitoring event.

The probe pressures recorded prior to the startup of the pumping systems ranged between 0.15 and 0.8 inches of water. The pressure variations in the shallow versus deep probes respond differently to barometric changes. In general the individual probe pressures varied on the order of 0.2 inches of water. A significant difference in the size of the pressure response of the shallow and deep probes was not observed in the limited data set that exists for static pressure information.

A pressure range from -0.33 to .65 inches of water was observed during the pumping test for the odour control system. Changes in the probe pressure represent the combined effects of a sudden change in the barometric pressure and a change due to the influence of the pumping test. In most cases, the pressure recovered after the initial pressure disturbance period had passed. In general the shallow probes showed a pressure range was about 0.1 inches of water lower (greater vacuum) than the deeper probes. The probes in the centre of the well field (GP5-88 to GP9-88) responded more quickly and strongly to changes in flow rates than the probes situated outside the pumping test triangle (GP1-88 to GP4-88). The variance in pressures

observed between the shallow and deep probes indicate that the cover material is behaving differently than the refuse material under pumping conditions.

The monitoring results for the probe nests show that the landfill gas in this area has a methane content ranging from 50 to 60 percent by volume. Under pumping conditions, the deeper probes yielded fairly constant methane concentrations, while the monitoring results for the shallow probes showed that the methane concentration decreased to as low as zero in some of the probes. The variance in the methane level was much more predominant under pumping conditions as the flow rate was increased.

The gas temperature in the deeper odour control probes on the Stone Church Road side of the landfill were measured in the range of 41 to 44 °C , while the upper probes were recorded in the range from 21 to 23 °C. The

refuse indicates that close to
landfill gas production and that the landfill is
active.

6.1.2 Pumping Evaluation

The analysis of landfill gas pumping test data must be carefully undertaken. The data analysis must take into account the barometric pressure influence and the effects of different pumping rates. In conjunction with the above noted variables, the data is compared on a probe by probe basis both horizontally and vertically. A pumping impact is ascertained by determination of a measurable decrease in the pressure or methane levels under the various flow rates. It should be noted that the influence of gas storage is extremely strong and that standard porous media flow equations do not apply since in a landfill the porous media is generating the flowing substance.

A summary of the analysis of the pumping test data for the odour control system shows that:

- a) At the flow rate of $0.18 \text{ m}^3/\text{min}$ (6.2 cfm);
 - no pressure response observed for gas probes nests GP1-88 to GP4-88;
 - pressure response noted at the probes in the interior of the gas well field triangle (GP5-88 to GP9-88), stronger response noted for the gas probes GP5-88 and GP7-88; and
 - no methane response noted for any of the probes under this flow rate.

b) At the flow rate of 0.3 m³/min (10.7 cfm);

- stronger pressure response noted for the interior gas probes of the well field,
- GP4-88 showed a pressure response,
- no methane response noted for any of the gas probe, and
- GP7-88 showed a negative pressure for both the deep and shallow gas probes. This probe is about 7.5 meters from GW2-88.

c) At the flow rate of 0.46 m³/min (16.3 cfm);

- strong pressure response noted for interior gas probes;
- increased pressure response for gas probes that are outside of the triangle area, mainly GP4-88 and GP3-88; and
- methane response in the probes situated in the cap of the landfill and in the triangle well field interior.

d) At the flow rate of 0.63 m³/min (22 cfm);

- pressure response for all but gas probes, interior well field probes show a stronger response than the exterior probes; and

- methane response is strong for the interior cover probes, several of the probes show methane levels at or approaching 0 percent methane by volume.

From the [REDACTED] it can be concluded that the [REDACTED] in (16.3 cfm) [REDACTED] At this radius the cover material has low methane concentrations and the probes situated in the refuse show a significant decrease in pressure to approximately 0 inches of water.

The gas generation rate for the Stone Church Road side of the site is estimated to be $0.009 \text{ m}^3/\text{kg}/\text{yr}$ ($0.15 \text{ cf}/\text{lb}/\text{yr}$). The following assumptions were used to predict the gas generation rate;

- an average depth of refuse of 22 meters
- radius of influence of 20 meters
- density of $0.83 \text{ tonnes}/\text{m}^3$ ($1400 \text{ lb}/\text{yd}^3$) (refuse only)
- flow rate of $0.45 \text{ m}^3/\text{min}$ (16 cfm) of 50 percent methane gas

The estimated generation rate predicts an average rate for both the saturated and unsaturated zones of the refuse. This reported value would classify the

site as a wet site which agrees with the refuse information from the drilling program and the elevated leachate levels at the site.

6.2 UTILIZATION SYSTEM

6.2.1 Landfill Gas Pressures and Quality

The static pressures in the landfill gas utilization system test area were measured prior to the startup of the pumping test. Static pressures were also collected during the test run of the pumping equipment on April 7, 1988 for some of the gas probes. The static pressure data varies similar to the odour control system in both the spatial and temporal domains. The static pressures range from 0 to 3.5 inches of water with methane concentrations ranging from 0 to 74 percent by volume. The gas temperatures were in the range from 20 to 42°C. In general, the average values recorded were in the range of 0.1 to 0.3 inches of water for pressure and 50 to 60 percent methane by volume. The probes with the higher pressures and lower methane levels were the deeper probes and appeared to respond as if leachate levels influenced the results of the gas probe.

The results of this pumping test were not as conclusive as the results of the odour control pumping test. The gas probes seemed to behave as two separate groups. The gas probes located to the east of the gas well showed no response to pumping of the well. The probes to the west of the well showed a significant response. This difference in response was extremely evident when GP11-88 results are compared to GP15-88 results. GP11-88 was located only 27 meters from the gas well and shows no significant response to the pumping. GP15-88 was located 40 meters from the gas well and showed a measurable response.

The data analysis was further complicated by the fact that a constant flow rate could not be maintained for the gas well. The pumping rate was increased, a high vacuum pressure (11 inches of water) was produced at the well head. This resulted in lower methane concentrations in the gas header which inferred that the gas well was drawing in air through the cover of the landfill site.

The gas probe data for the western probes showed that under pumping conditions the pressure decreased (lower vacuum) at the probes closest to the gas well. In most cases the pressure response was low when compared to the vacuum pressure that was present at the well head. Methane concentration response was not observed during the pumping of GW4-88 for any of the gas probes.

6.2.2 Pumping Evaluation

The analysis of the pumping data for the utilization well system was complicated by the lack of agreement between the information from the eastern and western parts of the test area. The following provides a summary of the monitoring results under the various flow rates:

a) At a flow rate of $1.0 \text{ m}^3/\text{min}$ (36 cfm);

- strong pressure response for intermediate level gas probes at GP12, 13 and 14-88;
- measurable response for upper level probes at GP12, 13 and 14-88
- slight pressure response for the remainder of the probes; and
- only a slight methane decrease for the GP12 and 13-88 (10%)

b) At a flow rate of $1.4 \text{ m}^3/\text{min}$ (50 cfm);

- strong pressure response for intermediate level gas probes at GP12, 13 and 14-88;
- slight pressure response for the remainder of the probes, the shallow probes responding more than the deeper probes; and

- only a slight methane decrease for the GP12 and 13-88 from static levels
- methane content dropping in the header

c) At a flow rate of $1.7 \text{ m}^3/\text{min}$ (60 cfm);

- strong pressure response for intermediate level gas probes at GP12, 13, 14, 15 and 16-88;
- slight pressure response for the remainder of the probes; and
- high well head vacuum, 11 inches of water
- methane concentration in the header at 25 percent.

From the results of the pumping data it can be concluded that the landfill in the area around the well was being influenced by pumping. The landfill appears to have a physical barrier preventing significant gas flow from the east to the well. There was no significant different response at the above noted flow rates that was apparent at probes GP12, 13 and 14. The zone of influence did not appear to extend beyond 40 metres at any of the tested flow rates. Increasing the vacuum at the well head yielded only minor gains in the flow rate and at greater than 11 inches of water column would be beyond the envisaged capacity of the collection system for the site to develop.

The gas generation rate for the Red Hill Creek side of the landfill was estimated to be about $0.006 \text{ m}^3/\text{kg}/\text{yr}$ ($0.09 \text{ cf}/\text{lb}/\text{yr}$). This value is questionable due to the unpredictability of the monitoring results that were recorded during the pumping test. The generation rate prediction was based on similar assumptions as the odour control system except that the radius of influence was 40 meters, the flow rate was $0.57 \text{ m}^3/\text{min}$ (20 cfm) of 55 percent methane gas and the depth was 22 meters.

The results for the utilization system show that the radius of influence can be increased with a deeper gas production well and that the cover does respond to the pumping of landfill gas.

6.3 LANDFILL GAS GENERATION RATE

The two pumping tests predict a gas generation rate for the site in the range of 0.006 to $0.009 \text{ m}^3/\text{kg}/\text{yr}$ (0.09 to $0.15 \text{ cf}/\text{lb}/\text{yr}$). These values are within the range that is typically reported for landfill gas recovery operations in North America. However, the values are lower than the gas generation estimates reported in the 1982 Upper Ottawa Street Gas Evaluation Study of 0.0145 to $0.056 \text{ m}^3/\text{kg}/\text{yr}$ (0.3 to $0.9 \text{ cf}/\text{lb}/\text{yr}$).

The difference between generation rates from the 1982 and 1988 gas evaluation studies are a result of several factors. These factors are:

- a) The six years time period between the two studies;
- b) The difference in landfill characteristics as noticed in the 1988 study; and
- c) the length of the 1982 pumping test (32 hours).

CRA's recent experience has found that short-term pumping tests do not reflect the landfill under long-term pumping conditions. This is mainly a result of the landfill having an extremely large storage capacity and that this affects the pumping test results. Thus, a short-term pumping test will provide a higher generation rate than is present at the site.

The results of the pumping test suggest that a flow of $1.4 \text{ m}^3/\text{min}$ (50 cfm) may be achieved from each production well and that under this flow rate a 30 metre radius of influence may be achieved under a vacuum that is at or slightly higher than the gas recovery industry average for vertical wells.

6.4 LANDFILL GAS ANALYSIS

A total of two landfill gas samples were collected from each of the headers for the two pumping systems. The first set of samples collected were used to determine the major constituent concentrations within the landfill gas, while the second set of samples were collected to determine the trace gas constituent concentrations. The samples were collected on June 1 and June 16, 1988 for the major and trace constituents respectively.

The results of the major landfill gas constituent sampling are present on Table 6.1. The results show a sample from the odour control system had a methane level of 63 percent, carbon dioxide level of 26percent, nitrogen level of 8percent and an oxygen level of 1percent. The sample from the utilization system had a methane level of 32 percent, carbon dioxide level of 15 percent, nitrogen level of 50 percent and an oxygen level of 2 percent. The results clearly show that atmospheric air intrusion into the odour control system was minimal but was significant into the utilization system.

Trace gas samples were collected from both of the headers at the conclusion of the gas study. The gas analysis focussed on determining the presence of targeted analytes comprising the following three compound categories;

TABLE 6.1
MAJOR LANDFILL GAS CONSTITUENTS

<u>Parameter</u>	<u>Odour Control System</u>	<u>Utilization System</u>
Methane	62.8	32.4
Carbon Dioxide	25.7	15.4
Nitrogen	7.78	50.3
Oxygen	0.9	2.3
Carbon Monoxide	<0.1	<0.1
Recovery	97.1	100.4
CH ₄ /CO ₂ ratio	2.4	2.1
N ₂ /O ₂ ratio	8.6	21.9

Note:

Analysis by University of Waterloo, Earth Sciences laboratory.

- 1) Sulphur compounds (hydrogen sulfide and low molecular weight mercaptans);
- 2) Halogenated hydrocarbons; and
- 3) Unhalogenated hydrocarbons.

The trace gas samples were collected on June 16, 1988 and analyzed by Mann Testing Laboratories Ltd. (Mann) of Mississauga, Ontario.

The analytical data reported by Mann for the samples collected is presented on Table 6.2 (Table 6.2 to be included in final report, CRA awaiting results from Mann). In addition, the trace gas analysis results from the 1982 Upper Ottawa Street Landfill Gas Study are presented in Table 6.3. These samples were collected from a shallow well under pumping conditions that is situated approximately 50 meters west of GW1-88 (odour control system).

Analysis of the trace gas results will be included in the final report.

TABLE 6.2

1988 TRACE GAS ANALYSIS
UPPER OTTAWA STREET LANDFILL SITE

TABLE TO BE INCLUDED UPON RECEIPT OF INFORMATION FROM
MANN TESTING

TABLE 6.3

1982 TRACE GAS ANALYSIS
UPPER OTTAWA STREET LANDFILL SITE

	Oct.20/82 1:30 pm	Oct.21/82 1:00 pm	Oct.21/82 2:00 pm	Oct.21/82 3:00 pm
n-hexane	29	23	22	25
dichloroethylene	20	16	13	32
acetone	608	486	453	547
tetrahydrofuran	17	16	16	16
methyl ethyl ketone	154	99	90	92
benzene	7	8	7	6
toluene	256	242	244	245
ethyl benzene	81	71	79	71
trichloroethylene	1.4	1.4	1.1	1.2
1,4 dioxane	10	9	10	5
butene (H/C) *	10	8	6	8
butanol *	13	11	9	9
hexane (H/C) *	9	8	6	8
hexanone (H/C) *	90	86	84	58
p-xylene *	34	51	41	23
o-xylene *	192	220	205	184
m-xylene *	84	85	86	86
C3-benzene *	10	15	19	11

Note:

All concentrations report in ppm on a volume basis

Samples collected in air bags.

* Approximate concentrations

7.0 LANDFILL GAS PRODUCTION

From the pumping test information, the gas generation rate for the Upper Ottawa Street landfill site is estimated to be in the range of 0.006 and 0.009 m³/kg/yr. This range falls within the predicted ranges outlined in Section 3 of this report. Based on these results the total annual gas production can be calculated and an estimate of the expected annual recovery can be estimated.

An estimate of the total landfill gas production for the Upper Ottawa Street Landfill Site was calculated based on historical site information, the results of the pumping tests and with assumptions based on typical landfill gas parameters and the site information available. The estimated landfill gas production for the site is presented on Figure 7.1. The estimate is based on the assumptions that are presented with Table 7.1.

The gas production curve was calculated based upon simulation that allowed for annual increases in refuse tonnage that was accepted at the site and the initial gas generation beginning two years later. The model did not take into account any of the refuse tonnage that was placed prior to 1966 in the gas production prediction. The model predicts the total annual landfill gas that is produced at the site from all gas producing refuse placed between 1966 and 1980.

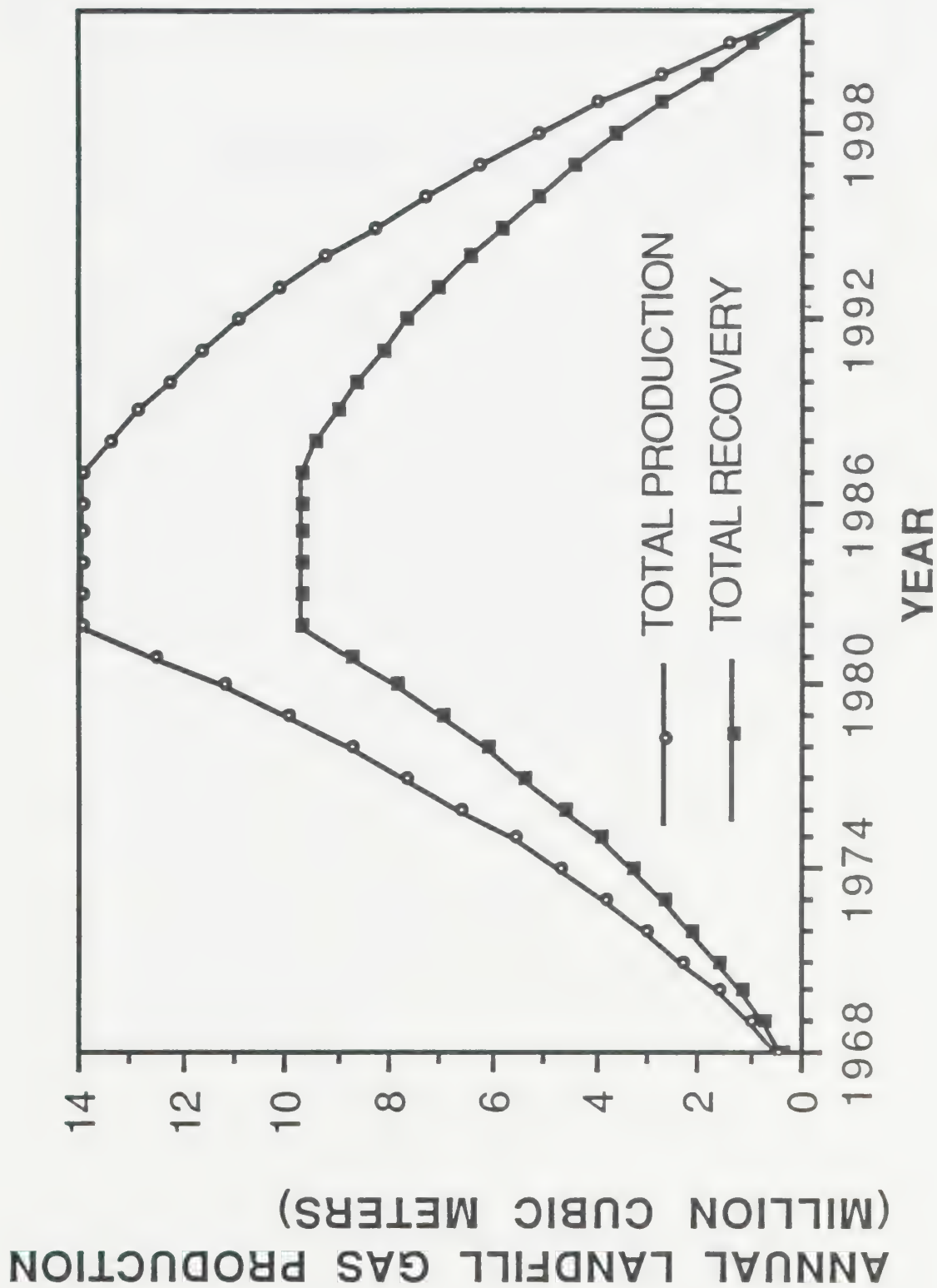


figure 7.1
 LANDFILL GAS PRODUCTION ESTIMATE
 UPPER OTTAWA STREET LANDFILL SITE
 Regional Municipality of Hamilton – Wentworth

TABLE 7.1

ASSUMPTION FOR LANDFILL GAS PRODUCTION
UPPER OTTAWA STREET LANDFILL SITE

- Maximum refuse tonnage for the site is 2 million tonnes
- 0.5 million tonnes of refuse placed prior to 1966
- 1.5 million tonnes of refuse placed during 1966 to 1980
- 7,000 tonne annual increase in refuse tonnage
- $0.009 \text{ m}^3/\text{kg}/\text{yr}$ ($0.15 \text{ cf}/\text{lb}/\text{yr}$) average annual gas generation rate
- $0.19 \text{ m}^3/\text{kg}$ ($3.0 \text{ cf}/\text{lb}$) total landfill gas yield
- Landfill gas is assumed to be 50 %methane and 50 % carbon dioxide
- Gas generation begins 2 years after placement

The landfill gas production estimate predicts that the maximum amount of landfill gas produced is 13.9 million cubic meters (490 million cubic feet) in 1982 to 1987. After 1987 the landfill gas production decreases to 12.3, 8.3 and 2.7 million cubic meters (434, 293 and 95 million cubic feet) for years 1990, 1995 and 2000 respectively.

It is stressed that the above prediction is based on the limited historical information available for the landfill site and that the estimate is directly related to the assumed volume of refuse that was placed on an annual basis at the site.

The annual landfill gas recovery estimate presented on Figure 7.1 assumes that 70 percent of all gas generated will be collected by the collection system. The 70 percent value accounts for inefficiencies in the landfill gas collection system. This efficiency value is commonly used in the landfill gas industry and is used to determine the economical return of any investimate. During the design of the gas collection system, every effort is made to reduce the inefficiencies of the collection system and thereby increase the percent of recoverable landfill gas.

The gas recovery curve presented on Figure 7.1 represents the annual amount of gas that could be collected from the site. The estimate

8.0 LANDFILL GAS UTILIZATION

8.1 INTRODUCTION

The scope of Phase I of this study included an investigation into the feasibility of gas recovery for utilization of the landfill gas being generated in the Upper Ottawa Street Landfill Site. As a prerequisite for the study, the physical limitations of the site and its potential gas production were assessed prior to reviewing the available markets and types of suitable uses of the landfill gas.

As noted previously in this report, there is a finite volume of gas that will be generated during the decomposition of the refuse. The Upper Ottawa Street site was closed in 1980. To pre-estimate the gas utilization potential, typical values were assumed for both the gas production rate and total volume of gas produced. It was recognized that following placement of a unit mass of refuse, it will take approximately 20 to 30 years to complete its gas production cycle (subject to varying site specific conditions).

Therefore, for the purpose of the utilization study, gas production of all refuse placed prior to 1970 was discounted. The maximum gas available (for purposes of this portion of the study only) was 750 cfm of

high quality landfill gas (>50percent CH₄). Peak gas production was assumed to have occurred by the year 1990 and to have dropped to nominally 0 by the year 2000 as the gas production cycle is completed for each unit mass of refuse.

The physical characteristics of a landfill site which are generally considered necessary for it to be considered as a reasonable prospect for a gas utilization project have been presented in Table 8.1. The suitability of the Upper Ottawa Street Landfill Site has also been summarized with regard to these characteristics.

The concern for the lifespan of the gas production is critical in the discussion of utilization because it must be the basis for the cost benefit analysis of any potential use for the landfill gas. The following sections will outline the major uses of landfill gas and will discuss the potential of the Upper Ottawa Street Landfill Site for gas recovery utilization.

8.2 GAS UTILIZATION

There are three primary options available for the utilization of landfill gas:

1. Industrial Usage (upgrade to pipeline grade natural gas);
2. Electrical Power Generation (using modified natural gas engines or gas turbines); and
3. Heat Generation (steam, hot water, etc).

There are numerous variations and combinations of two or more of the above which will be shown not to be relevant to this study and will not be discussed here. A major consideration, which is relevant to this evaluation, is verification that the end usage of the landfill gas insures that the air emissions have been effectively controlled to meet the Ministry of the Environment's current guidelines for landfill sites.

8.2.1 Industrial Usage

The upgrading of the landfill gas from a low BTU (<500 BTU/ft³) fuel to a pipeline grade fuel (1000 BTU/ft³) for transmission through a private or existing utility pipeline to an industrial user(s) is technically but not economically feasible. The estimated maximum value of the fuel available from this site is approximately \$200,000 per year in 1990 and as previously noted, the gas production will rapidly decline in the following decade. The total value of available gas is assumed not to exceed \$1,000,000

(in 1988 dollars) over the life of the site. This assumes that full commercial value is given to the landfill gas which is an overly optimistic assumption. Regardless of the above, further investigation of this option was not warranted because of the large capital costs required for a process plant and pipeline to upgrade the fuel. A gas flow of almost an order of magnitude larger and maintainable for a minimum of ten years is required before this option would even be considered.

8.2.2 Electrical Power Generation

The installation of an on-site electrical generating station is also technically but not economically viable. At the present time, the rate of return which Ontario Hydro will pay for the electrical power is insufficient to cover the capital costs of the installation and maintenance of a generating station. This is a closed site with no existing hydro requirements and therefore, all of the electricity would have to be sold to the utility at a loss. Based on Ontario Hydro's current position, this is not a viable alternative.

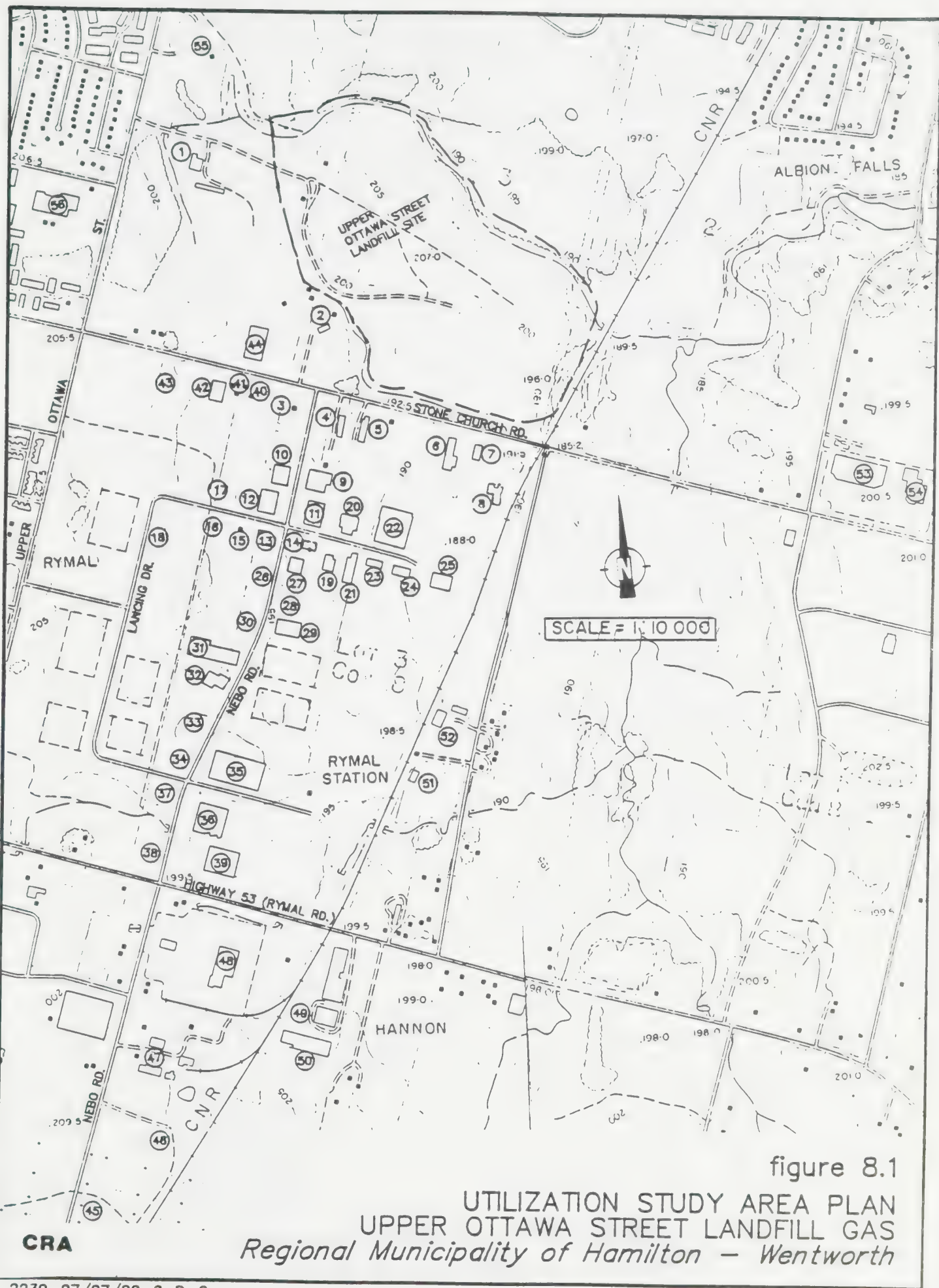


TABLE 8.2

LANDFILL GAS UTILIZATION SURVEY
LIST OF SITE VICINITY COMPANIES

- 1) City of Hamilton Public Works ; District #4 Garage. *
- 2) Hamilton Fire Department ; Fire fighting training facility. *
- 3) Adanac Ornamental Ironworks ; Structural steel works. *
- 4) Demik Construction Ltd. ; small contracting firm office/yard facility.
- 5) Hess Machinery ; steel mould manufacturer. *
- 6) P.J. Daly Contracting ; plastering and drywall firm.
- 7) Mountain Star Gymnastics ; small gymnastics training facility.
- 8) Bell ; field maintenance/office facility.
- 9) 45 Nebo Rd. ; One story office/warehouse building houses:
 - 1) Bear Automotive Inc.
 - 2) Palm Pools Ltd.
 - 3) Progress Construction
 - 4) A.M.G. Automotive
- 10) One story office/warehouse building houses:
 - 1) Fox Refrigeration
 - 2) W.J. Westaway Inc.
- 11) One story office/warehouse building housing:
 - 1) Union Electric Supply Co.
 - 2) The Lighting Center
 - 3) Olivetti Sales and Service
- 12) One story office/warehouse building housing:
 - 1) The Power Chemical Group
 - 2) Patersons Cleaning Services
 - 3) Dial Com Cellular Phone Specialist
 - 4) Terra Cleaning Services
 - 5) Reilly's (the potato specialist)
- 13) Two story office/warehouse:
 - 1) Expert Boiler Service
- 14) One story building housing:
 - 1) Giovanni's Deli
- 15) Two story office/warehouse building:
 - 1) AMA Roofing Supplies
 - 2) Claudes Roofing /Ltd.
- 16) Small one story office/warehouse building housing:
 - 1) Aran Trophies
- 17) Large one story office/warehouse building housing:
 - 1) Murray T.V. (Unit3)
 - 2) Fortino's Supermarket (office/warehouse space)
 - lease space available.
- 18) Small one story office/warehouse building housing:
 - 1) Beam Built-in Vacuum
 - 2) 5000 sq.ft. available for lease
- 19) EZ Custom Kitchen Cabinet ; one story office/warehouse building.
- 20) Lancaster Sheet Metal Ltd. ; sheet metal fabricator. *
- 21) One story office/warehouse building housing:
 - 1) Jomelar Elastomer Ltd. (manufactures urethane products)
 - 2) Graphic Access
- 22) Domglas Inc. ; large one story office/manufacturing building.
(machine shop , mould design and manufacture) *
- 23) One story office/warehouse building housing:
 - 1) Keegan Forklift Services
 - 2) Solid Machine Shop Inc.
- 24) Small one story office /warehouse building housing:
 - 1) Dave's Engine Service
- 25) Small one story office/warehouse building:
 - 1) Roger Control Systems Inc.
- 26) Warehouse/office complex under construction (22,000 sq.ft.)
- 27) 115 Nebo Rd. ; office/warehouse housing:
 - 1) ATW Overseas Moving Ltd.
 - 2) Home Repair and Maintenance Services
- 28) Warehouse/office space housing:
 - 1) Royalty Kitchen Cabinets and Custom Woodworking
 - 2) Carlos Brothers Excavating
 - 3) Silkworm "Plants of Distinction Forever Green"
- 29) The Bakery ; moderate to large baking company.
- 30) Warehouse/office space under construction to house:
 - 1) Boxed Meat Revolution
- 31) Warehouse/office space housing
 - 1) The Flooring Warehouse
 - 2) Armstrong Floor Fashion Center
 - 3) Midgley & West Ltd. (ceramic tile distributors)
- 32) Warehouse office building housing:
 - 1) Wentworth Tile
- 33) Warehouse/office -
 - 1) Standard Paint and Wallpaper
- 34) Warehouse/office building housing:
 - 1) PFF Import Export
 - 2) Ceramica Tile Center
 - 3) Sabel's Bathrooms Ltd.
 - 4) Lighting Magic Ltd.
 - 5) The Ultimate Closet Shop
- 35) Pepsi (large warehouse/distribution center)
- 36) Forwells Supermarkets (distribution center)
- 37) Small two floor office/retail building
- 38) Office/retail building:
 - 1) Peggy Sue's Restaurant
 - 2) Fireplace Solution (retail store)
- 39) Cashway Building Center (lumber supply store)
- 40) Caspers Stereo Warehouse (in small house)
- 41) Private dwelling
- 42) Warehouse/office/retail building housing:
 - 1) Jan Cabinets
 - 2) McQuire's (candy store)
 - 3) Demerling Electric Supply Ltd.
- 43) Warehouse/office building housing:
 - 1) Rust Check
- 44) Hamilton Rolier Gardens
- 45) Quality Ready Mix ; concrete mix plant. *
- 46) Dufferin Construction ; construction materials stockpile yard.
- 47) Cashway Building Supply ; warehouses.
- 48) Shaw Pipe ; large steel pipe fabricator.
- 49) Parson's Unit Step Ltd. ; concrete walkway manufacturer. *
- 50) Walter's Welding ; structural steel fabricator. *
- 51) Armour Steel ; steel beam supplier (small operation).
- 52) Co-Op Seed & Supply Company.
- 53) Hamilton Bowl ; bowling lanes , moderately sized complex.
- 54) Circle Racquetball Club
- 55) CBM ; concrete mix plant. *
- 56) Blessed Kateri Tekakwitha School

NOTE: * Indicates companies deemed most suitable for gas utilization facility and contacted (refer to completed survey forms, Appendix E).

to 12,000 dollars for their winter season. The plant operation is expected to continue at the present operating levels but management noted that they are subject to economic trends and a downturn in the area construction work may be accompanied by their winter closure in the future. They would not be willing to guarantee their fuel usage. Payment would have to be based on metered flow.

Depending on the final location of the proposed gas control plant, the pipeline from the landfill site to the concrete plant would be between 300 and 500 metres long. It is therefore apparent that the capital construction costs of the pipeline and necessary plant modifications would greatly exceed the potential revenue from the sale of the landfill gas.

[REDACTED]
[REDACTED] from the Upper Ottawa Street Landfill. Further investigations into the recovery of the landfill gas for utilization are not warranted.

9.0 PRELIMINARY DESIGN AND DESIGN RATIONALE

9.1 GENERAL

The primary objective in the design of a gas control system is to prevent the migration of landfill gas beyond the limits of the landfill site, both in the air and below grade.

The landfill gas control system for the Upper Ottawa Street Landfill is comprised of the following four major system components:

1. the well field;
2. the header system;
3. the blower building; and
4. the incinerator system.

The relationship between the four main subsystems noted above, the nature of their interaction and the design rational will be described in the subsequent sections.

Preliminary design drawings (copies enclosed) have been prepared for the Upper Ottawa Street Landfill Site and include the following:

Drawing 1	Existing Conditions and General Site Layout
Drawing 2	Header Pipeline Profile and Typical Cross Section
Drawing 3	Miscellaneous Details
Drawing 4	Typical Blower Building Plan and Profile

9.2 WELL FIELD

The well field is defined as the vertical wells and subheader pipe network to be installed within the refuse disposal areas of the site. At the Upper Ottawa Street Landfill, the well field will consist of 28 vertical wells, which in conjunction with 8 subheaders will collect and route the landfill gas to the header pipe system. As noted in Drawing 1 (enclosed), the vertical well grid has been laid out to blanket the entire south side of the landfill site. The wells are spaced at approximate centres of sixty metres subject to practical constraints such as the location of existing access roads and top and bottom of side slopes.

A major constraint for the well field design results because the nature of a landfill is such that it is subject to relatively large settlements. Settlement of a lift of refuse is estimated at 25 percent of the lift height with 50 percent of this occurring within the first two years.

The Upper Ottawa Street Landfill Site was closed to refuse placement in 1980. Although significant settlement of the site can still be expected, (relative to conventional building sites and pipeline construction) it has been assumed that no further major differential settlements will occur. To insure the structural integrity of the pipeline and provide the necessary flexibility, a high density polyethylene pipeline (HDPE) has been selected. The header and subheader pipelines will be continuous and connected with butt fused joints. The connection of the vertical wells to the subheaders is the weakest link in the system and may still be susceptible to settlement damage. A slip joint will be provided at each well connection to reduce the risk of this potential damage. The vertical wells (see detail Drawing 3, enclosed) will also be constructed with a telescoping vertical section to allow it to slide as the landfill continues to settle.

Excavation into the cover over the landfill is likely to expose the refuse in some areas of the site , especially in the vicinity of the vertical well connections. This will result in a potential for exposure to landfill gas in the excavations and work areas especially during connection of

the vertical wells to the subheader piping. Extreme care must be exercised as is subsequently outlined in Section 9.2 of this report.

A major consideration of the design is the minimization of air infiltrating into the collection system through the landfill cover for the following reasons:

1) Air Emissions;

- The incinerator will not operate efficiently at low methane concentrations and a practical minimum concentration to support combustion is approximately 25 percent CH₄ by volume.

2) Safety;

- The explosive range for methane in air is between approximately 5 and 15 percent by volume.

The vertical wells are expected to be operated under a maximum vacuum of 3 to 5 inches W.C. The spacing of the vertical wells and the operating vacuum have been established as a result of the pumping test results and information obtained in previous field test research programs conducted at other similar landfill sites. The spacings provided have proven adequate to generate overlapping zones of influence to effectively collect the landfill gas being generated. The optimal condition is to generate a zone of

influence around each well which approaches the final capped surface of the landfill and results in a zero pressure gradient at this point and to overlap the influence areas of adjacent wells to blanket the entire surface area. By establishing a zero surface gradient there will be neither inflow of air nor outflow of gas from the landfill.

The gas flowrate will be regulated from each well using data obtained through the gas monitoring port for the individual well. Gas concentrations (CH_4 and O_2), temperature and static pressure will be monitored and used to determine the control valve setting for the well. The valves will be adjusted to maximize the landfill gas draw that can be obtained without degrading the methane concentration or increasing the oxygen concentration of the landfill gas. The eventual system startup will require an intensive adjustment stage to balance the well field to meet the above noted criteria. Daily monitoring rounds will be required during the first week of continuous operation of the system. Following the stabilization of the well field, the monitoring frequency can be reduced to weekly and eventually monthly. The vacuum draw at each well will initially be set at 2" W.C. vacuum and adjusted on a daily basis until stabilized. A detailed startup procedure will be required from the contractor for the plant operation and startup. CRA will provide a detailed procedural guideline and assistance to the Region during the balancing phase of the well field. There is expected to be significant variance in the gas recovery rates from different areas of the landfill.

The regular monitoring rounds will also serve to assist in identifying and locating a problem area that develops in a portion of the piping system. An ambient static pressure reading at a well may indicate a line blockage or other structural problem.

Should the failure of the subheader/vertical well system occur in a localized area due to line blockage (condensate collection or pipe failure), the severed area of the landfill may be reserviced by the installation of an additional vertical well(s) and subheader connection. The subheader piping will be installed with a grade (≥ 1 percent) either toward the vertical wells or toward the main header to insure that any free moisture being carried with the landfill gas will either drain back into the landfill site through the vertical wells or be routed into the sanitary sewer system. the condensate will be removed from the header system at the condensate trap chamber.

9.3 HEADER PIPE SYSTEM

9.3.1 General

The header pipe system is defined as the pipeline designed to transport the landfill gas from the well field to the blower building and is comprised of the following major subcomponents:

1. Header Pipeline; and
2. Condensate Trap Chamber.

9.3.2 Header Pipeline

The header pipeline shall be constructed in or below the cover material over the refuse through the centre of the disposal area of the site. The pipeline will be high density polyethylene pipe (HDPE) with butt fused joints and lateral connections from the subheaders, to form a continuous pipeline through the condensate chamber into the moisture separator.

The header pipeline has a minimum grade of 0.5 percent toward the condensate chamber to insure the drainage of the condensate from the pipe system. It is generally recommended that a minimum 2 percent grade be applied to all header piping installed within the refuse limits. The age of this site and nature of the in situ cover material have permitted this design criteria to be somewhat relaxed for the Upper Ottawa Street site. Further modification of the pipe grades in the level area across the peak of the landfill will be reviewed in the detailed design. It is critical to insure that low points, which can eventually create water traps in the pipe system, be prevented.

The diameter of the main header (200-315 mm) has been sized to insure that it has the capacity to accept the gas flow from a series of subheaders and vertical wells which may be necessary on the north half of the landfill site in addition to the wells and subheaders shown on the preliminary design drawings.

9.3.3 Condensate Trap Chamber

The primary objective of the removal of the condensate is to prevent the migration of moisture in the pipe network to the blower

building, which could eventually cause fan operation problems and reduce the efficiency of the landfill gas control system.

Methane gas removed from the landfill will be a saturated gas due to the environment in which it is produced. As the warm gas (approximately 30° - 40° C) travels along the pipeline, condensate will form as cooling prevails. The condensate will travel along the pipeline in the direction of flow in the form of a free liquid.

The condensate trap has been designed to remove as much of the free moisture travelling in the pipeline as possible. The abrupt change in direction of the gas flow as it is rotated 90° to exit through the roof of the precast condensate chamber will enhance the collection of the free-flowing condensate through a gravity drainage system.

To maintain the vacuum and prevent the entry of air into the piping through the condensate drain system, an elongated "P" trap has been designed to provide a depth greater than the maximum list which can be developed by the blowers.

The condensate trap chamber is the termination of the header pipe system. The pipe leaving this chamber and continuing above

grade through the blower building to the gas burner(s) will be Schedule 40 steel pipe.

9.4 GAS CONTROL PLANT

9.4.1 General

The gas control plant serves primarily to house the blowers, piping, electrical services and the primary system disconnect switches. To effectively describe the facility it will be divided into the following major subcomponents:

- 1) blower building
- 2) blower(s)
- 3) moisture separator;
- 4) steel piping;
- 5) safety systems; and
- 6) electrical/control room.

Each of these components is briefly described in the following sections to provide a general understanding of the plant and the major design considerations.

9.4.2 Blower Building

The potentially explosive nature of the landfill gas being handled in the blower building has created two major design constraints on the building design:

- 1) Explosion prevention; and
- 2) Explosion release.

To insure that the risk of an explosion resulting from a spark from an electrical device is minimized, the blower room is [REDACTED]. The result of this hazardous classification [REDACTED] within the blower [REDACTED]. In addition to these equipment requirements [REDACTED].

To meet the second constraint, the Ministry of Labour requires that the hazardous area be protected by some form of explosion release mechanism that effectively prevents structural damage to the building in the event that an explosion does occur. ~~The general~~
~~the~~
volume be able to open and release the explosion at a pressure of approximately one KN per square metre (20 psf).

Capital cost considerations in conjunction with the above noted design constraints required that the building design include the following:

~~Minimize~~ Minimize the size of the blower room to reduce the blowout area required and the number of explosion proof electrical devices required;

~~The~~ The system controls should be installed in a separate electrical/control room that has no direct access into the blower room and is completely sealed off from it. the electrical room will have a separate ventilation system and all electrical conduit and wiring between the two rooms must be properly sealed.

~~The~~ The building must be protected with a gas detection and warning system.

9.4.3 Blowers

The gas blowers recommended for this project are essentially high volume, low pressure sealed fans. Each of two blowers will be capable of developing a total pressure between 30 and 40 inches W.C. and a combined maximum gas flow rate of approximately 2,000 cfm. The blowers will generate a vacuum of approximately 20 to 30 inches W.C. which provides the necessary draw to extract the landfill gas from the well field within the refuse. The vacuum developed will be adequate to produce five inches W.C. vacuum in each of the vertical gas wells after reduction for the friction losses in the pipeline and through the equipment, valves and fittings. The blowers and all piping will be sized to provide the capability to add any additional wells from the north side of the site that prove to be required in future.

One blower should be capable of meeting the initial gas extraction flow requirement of the landfill site. The second unit will be installed as a safety precaution to safeguard against system shutdown due to a blower failure or during maintenance operations. Should additional wells be added to the north side of the site, the second blower may have to be put into regular service.

9.4.4 Moisture Separation

A centrifugal type fibreglass moisture separator has been designed to remove the remaining moisture carried in the gas stream after it exits the condensate chamber.

The moisture separator has no moving parts. As the gas enters the separator through a tangential entry, it is forced to spiral down around the centre core of the unit to its base. The gas is then pulled up through the centre core the separator and exits into the downstream piping. All of the moisture is similarly forced to travel down in the gas stream but the vacuum is not able to lift the condensate up to the discharge. As the moisture accumulates in the base of the separator it will drain through the drainage lines and be discharged to the leachate collection system.

Since the moisture separator is operated under a vacuum it requires an in-line condensate receiver on the drain line to provide a reservoir with the capacity to fill the drainage lines and prevent the entry of air into the moisture separator. The condensate receiver serves the identical purpose of the extended "P" trap in the condensate chamber.

Since there are no moving parts in this system it should be relatively maintenance-free but the drainage system must be periodically

checked to insure there has not been a blockage on the drain line or a leak in the piping permitting entry of air into the system.

9.4.5 Steel Piping

All of the piping above grade will be Schedule 40 steel pipe. the design of the piping system in the blower room should be layed out to minimize the room size as required by the explosion relief criteria.

The pipe system includes valves on each side of a blower to permit the isolation of the unit for regular maintenance, repair or replacement if required.

The entire piping system in the blower room can be isolated by a pneumatic valve which shall be located immediately outside the blower building upstream of the moisture separator. This valve will be designed to close automatically in the event of either a power failure or a fault occurring in the blower/incinerator system causing the system to shut down.

9.4.6 Safety Systems

There are four systems that shall be designed to provide for the safe operation and maintenance of the blower building incinerator system:

- 1) Electrical system overloads, disconnect switches and blower motor protection relays, etc.;
- 2) Explosion-proof equipment in blower room;
- 3) Nitrogen/pneumatic system; and
- 4) Methane gas detection system.

All equipment should be protected to minimize the risk of damage due to an electrical overload, and shut down in the event of faulty or unstable equipment operation.

All electrical devices (motors, switches, lighting, etc.) in the blower room shall be explosion-proof, and all entry points into the blower room should be sealed.

The nitrogen/pneumatic system should close the pneumatic valve located in the blower room, thereby shutting off the source of the landfill gas in the event of a power failure or other problem resulting in a system shutdown.

The gas detection system should detect methane gas levels in the blower room. A gas reading of 40 percent of the lower explosive limit (LEL) should result in an alarm condition.

The plant alarm system, if activated, should result in the following:

- 1) Energizing red flashing alarm lights mounted on the exterior walls of the blower building; and
- 2) Signalling an alarm condition through a telephone auto-dialer to the necessary remote locations as determined by the Regional Municipality of Hamilton-Wentworth.

All fault/alarm conditions should receive immediate attention. The identified conditions should include the following:

- 1) High methane concentrations detected in the ambient air in the blower building;
- 2) Spontaneous shut down of an incinerator; and
- 3) Shutdown of a blower as a result of a fault or overload condition.

The recommended safety protocol is subsequently described in Section 9.6.

9.4.7 Electrical/Control Room

The electrical room houses all of the main and secondary service panels, motor starters, disconnect switches, the gas detection panel and all of the other miscellaneous control devices necessary for the operation of the plant and incinerator system control. The electrical room is not protected as an explosion proof environment and therefore all piping and conduit between the blower room and electrical room will be properly sealed at both sides of the adjoining wall.

9.5 INCINERATOR SYSTEM

The incinerator system shall be designed, manufactured and installed by a subcontractor experienced in the design and construction of these systems. The incinerator design must meet general design constraints and parameters which will be outlined in the Contract Drawings and which will be as per the Ministry of the Environment's current design recommendations that require the incinerator to provide a minimum of one second retention time at 1,000°C.

The incinerator system shall be comprised of a vertical cylindrical drum lined with a refractory material, having a burner arrangement at its base. An automatic propane pilot system will be provided to ignite the gas, complete with the necessary control valves and flame protective device. The flow of gas to the incinerator will be controlled by an electrically operated burner valve which will use a pressure controller/transmitter to control the flow of landfill gas to the stack. A flame arrestor will be provided immediately upstream of the control valve to prevent a flame flashback into the pipe system. Temperature control will be maintained with the use of a thermocouple and variable air intake dampers. A programmable logic controller will be furnished to automatically control all of the equipment and operate the system based on preset temperature and pressure parameters.

9.6 HEALTH AND SAFETY

9.6.1 General

[REDACTED] ch will be involved in the operation and maintenance of the gas control incinerator plant must be familiar with, and rigidly [REDACTED] established in the following sections in addition to all of the [REDACTED] the requirements outlined herein will become a supplement to the current health and safety protocols where additional protection may be required.

The provisions subsequently described should be applied to all construction work carried on within the refuse disposal areas of the landfill site and to all future maintenance work related to the gas control system.

9.6.2 Site Safety

- a) Assure that the Contractors' agents, workmen, employees or any persons under its control, including subcontractors, shall be fully aware of the

combustible and explosive nature and of the suffocation hazard of the landfill gases, including methane, carbon dioxide and mercaptans, some of which are poisonous;

b) Take the [REDACTED] to ensure the avoidance of hazardous conditions on Site. No open flame, matches, smoking, welding or other activity potentially capable of generating an explosion shall be allowed in any area associated with landfill gases. Field welding, if required shall only be permitted under well ventilated conditions and only with the written approval of the Region. Particular care shall be taken in relatively confined areas such as trenches and over the gas wells;

c) [REDACTED] in the form of signs or symbols informing personnel of the danger from combustible gases. Signs such as:

- 1 Danger - Keep Away - Explosive Gases
- 2 Danger - No Open Flame or Matches
- 3 Danger - No Smoking

shall be posted along each temporary work area.

d) Provide an approved temporary gas tight cap at all cessations of pipe laying until further horizontal lengths of pipe are ready to be fitted and ensure

that the temporary cap is removed for installation of further pipe only under well ventilated conditions.

- e) Monitor the gas concentrations in all trenches and other enclosures for this project, provide temporary forced draft ventilation facilities if, in the opinion of the Region, ventilation is required to deal with the detected combustible gas or other odourous gases, for the safety of the workmen.

9.6.3 Supplementary Safety Protocol (Post Construction)

Following are additional recommended safety regulations that should be implemented by the Region following completion and turnover of the gas control system:

- 1) No smoking should be permitted within the plant compound;
- 2) The blower building should be kept locked at all times except during monitoring and maintenance operations.
- 3) All compound gates should be kept locked except during maintenance and monitoring operations.

- 4) Only personnel authorized by the Region should be permitted within the plant compound.
- 5) No entry permitted into the blower room until the gas detection system in the electrical room is checked for safe gas readings.
- 6) Hearing protection is recommended inside the blower room during maintenance work performed when the blower(s) are in operation.
- 7) The belt guards for the blowers should never be removed while in operation.
- 8) No extension cords and power tools are permitted inside the blower room unless a portable gas monitoring device is present and in use at all times.
- 10) All personnel must be warned that the exterior surfaces of the incinerator stacks can burn on contact.
- 11) All plant personnel must be thoroughly advised of the potentially explosive nature of the landfill gas.

9.6.4 Safety Recommendations

The following list of recommendations are intended as a general outline for the necessary measures to insure the safe construction and maintenance of the gas control system:

1) Safety Officer

- A site safety officer should be appointed and given the authority to monitor all activities related to the landfill gas system and its safe operation. This function could ideally be combined with the monitoring duties for the gas system.

2) Training

- All site and construction staff must be given a training session to outline the site safety regulations and procedures.

3) Entry Protocol

- Entry to the condensate trap chamber or other similar subgrade structures must be in groups of two or more workers. No individual entry into any chamber is permitted. A portable meter with an audible alarm must be

10.1 CONCLUSIONS

The following conclusions are made based on the investigation and data presented and evaluated in this report.

- 1) Technical literature review and pumping test data indicate that landfill gas generation rates of 0.15 cf/lb/yr for unsaturated waste and 0.5 cf/lb/yr for saturated waste are appropriate values to use for evaluation of the Upper Ottawa Street Landfill Site.
- 2) Technical literature review and peer review suggest that total landfill gas yield on the order of 2.5 to 3 cf/lb waste is an appropriate range of values for the total gas yield as defined in this evaluation.
- 3) The pumping test results indicate that there is still a significant landfill gas generation rate at the Upper Ottawa Street Landfill Site. The shallow odour control test wells were capable of maintaining a 20 cfm flow of high methane content gas (50 percent+).

- 4) The pumping test results indicate that the thick cover of ~~heavy~~ steel industry ^{solids} waste, in addition to the final cover material, provides an excellent buffer for landfill gas extraction and should reduce air intrusion. The unusually thick landfill cover will permit pumping at high relative vacuums and should insure that a minimum radius of influence of 30 metres can be maintained for the vertical wells.
- 5) The results of the pumping test indicate that there may be quite extreme variations in the gas generation rates in different areas of the site.
- 6) The results of the pumping test imply that the gas production rates are higher in the southern half of the landfill site.
- 7) The technical literature review and the historical research of the landfill site, in addition to the test study, indicate that significant landfill gas generation and associated odour problems can be expected at least until the year 2000.
- 8) There is limited potential for landfill gas utilization. The landfill gas generation at the site is beyond its peak production years and the volume of gas being produced will rapidly decline over the next decade. Capital cost considerations are the major drawback to a gas utilization scheme.

The MOE guidelines for air emissions greatly restrict the number of potential gas users for the untreated raw gas.

10.2 RECOMMENDATIONS

The following recommendations are made as a result of the investigation and conclusions presented in this report:

- 1) An active landfill gas odour control system should be installed in the southern half of the Upper Ottawa Street Landfill Site.
- 2) Vertical wells should be utilized to collect the landfill gas. The wells should have a minimum five metre screened section below the existing cover material to collect the gas. The wells should be designed to operate at a maximum vacuum of five inches W.C. and to initially yield a maximum of 50 cfm of landfill gas per well.
- 3) Twenty-eight wells have been utilized in the preliminary design yielding a potential flow rate of 1,400 cfm. The control system must be designed to accommodate this maximum flow but it is expected that the actual average

well yield will be closer to 25 cfm per well and the expected total system flow will be 700 cfm.

- 4) Each gas well should remain in operation until its gas yield drops below 10 cfm with a methane concentration of 25 percent by volume.
- 5) The blowers, incinerators and related equipment must have the capability to operate down to a low flow of 200 cfm.
- 6) A gas control system extension into the north side of the landfill site should be re-evaluated in the future. The gas yields of the wells adjacent to this area should be evaluated and additional gas monitoring probes should be installed in specific areas if high gas production rates are apparent.

APPENDIX A

GAS WELL AND GAS PROBE

INSTRUMENTATION DETAILS

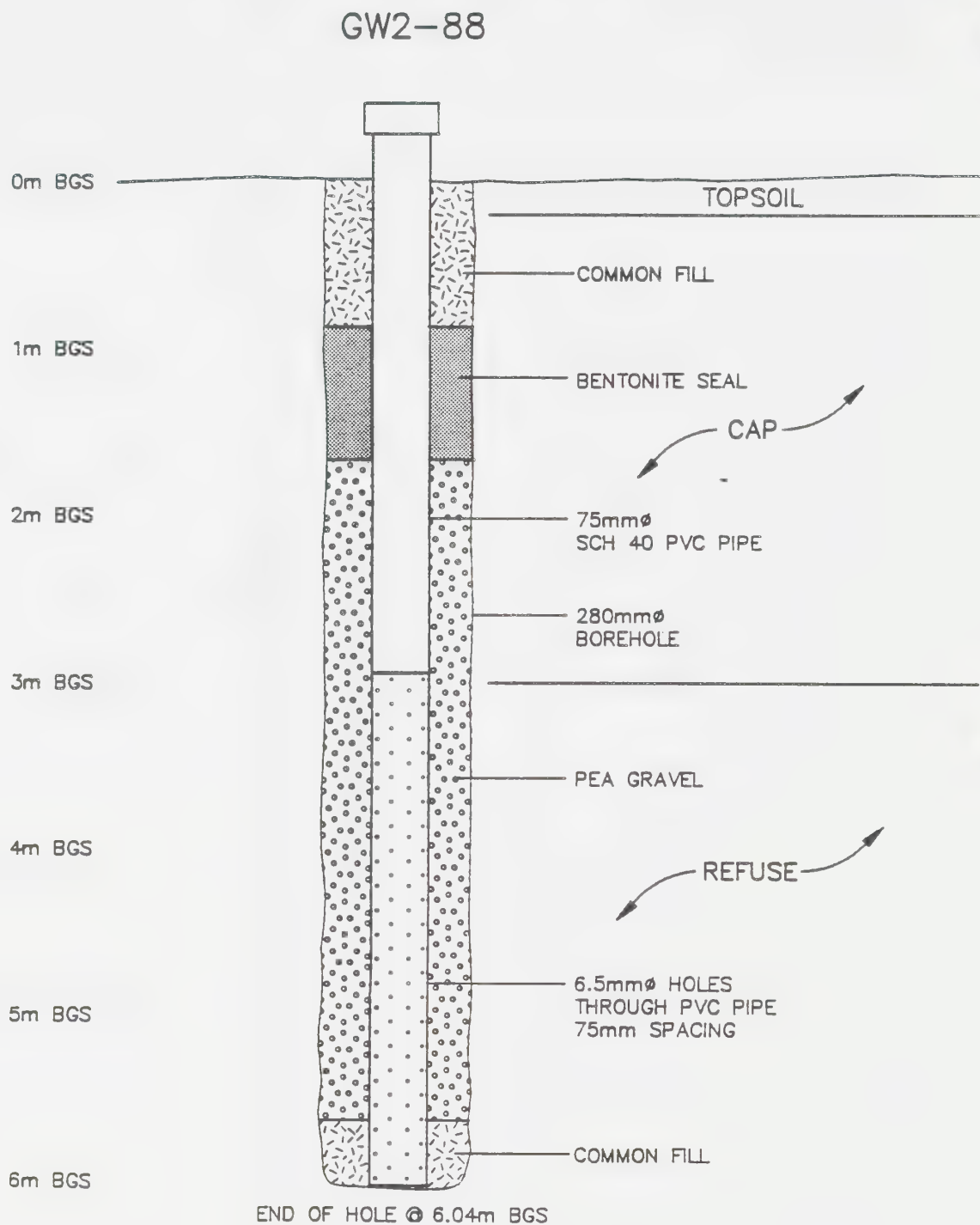


figure A.2

GW2-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

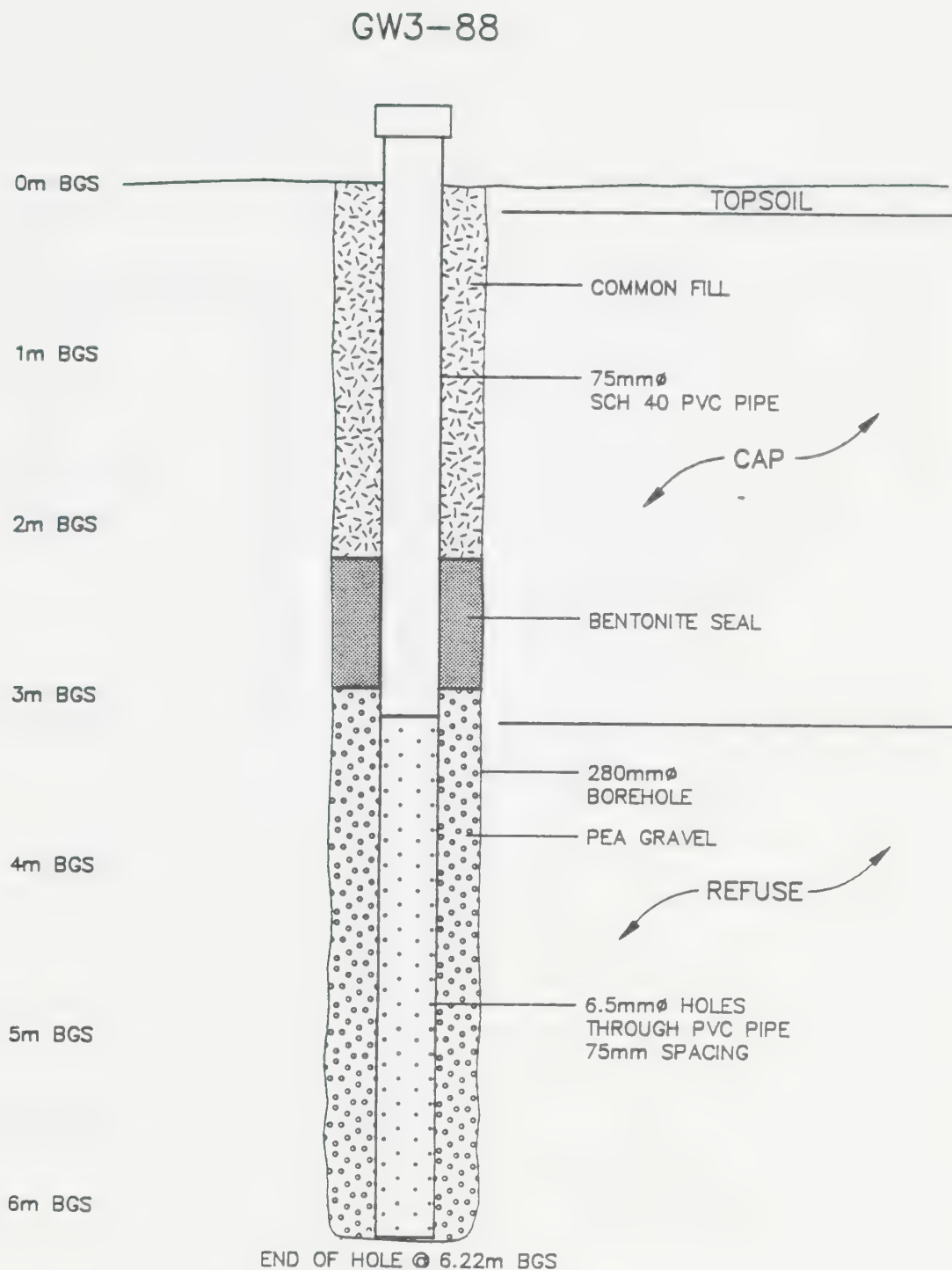


figure A.3

GW3-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

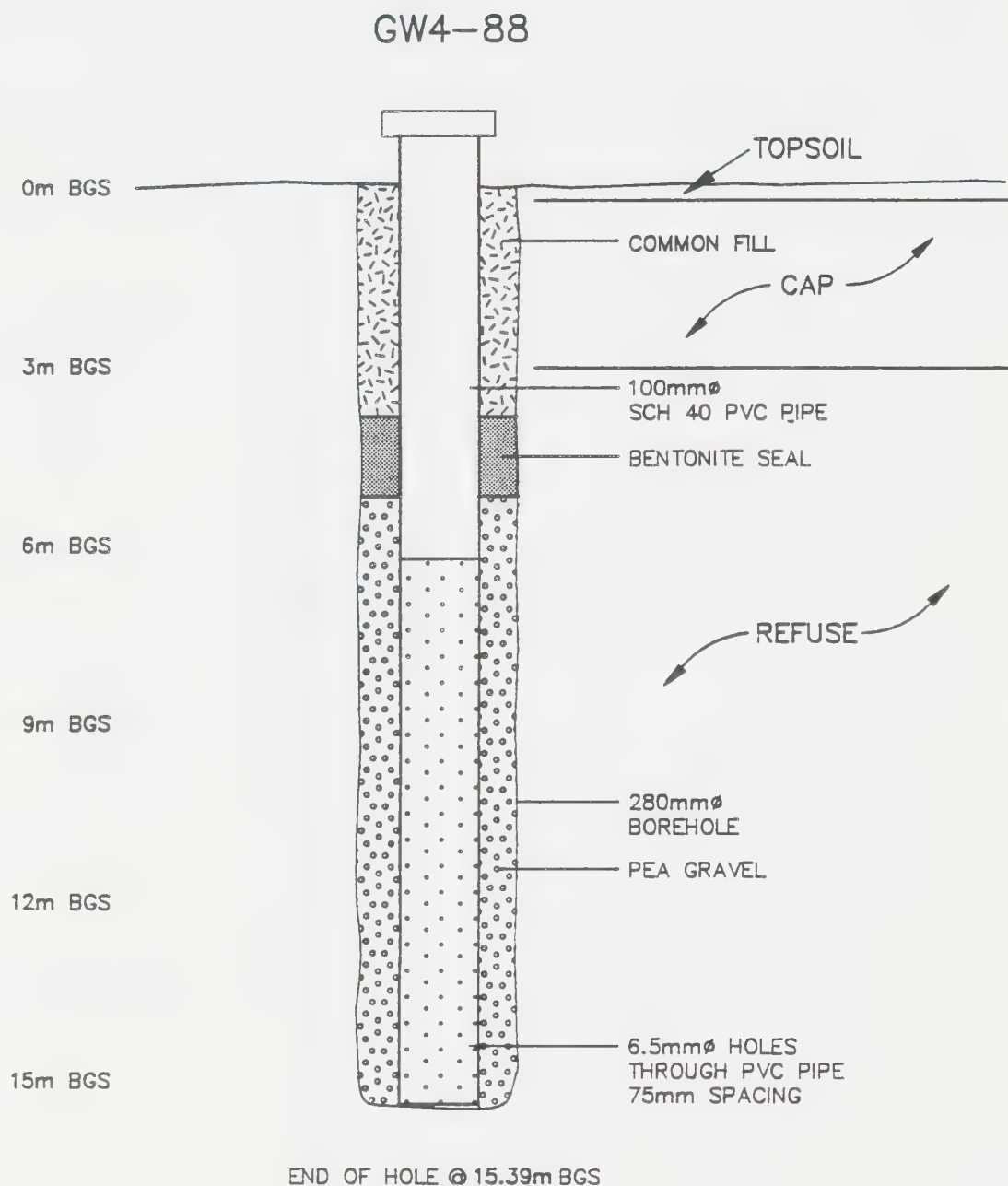


figure A.4

GW4-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

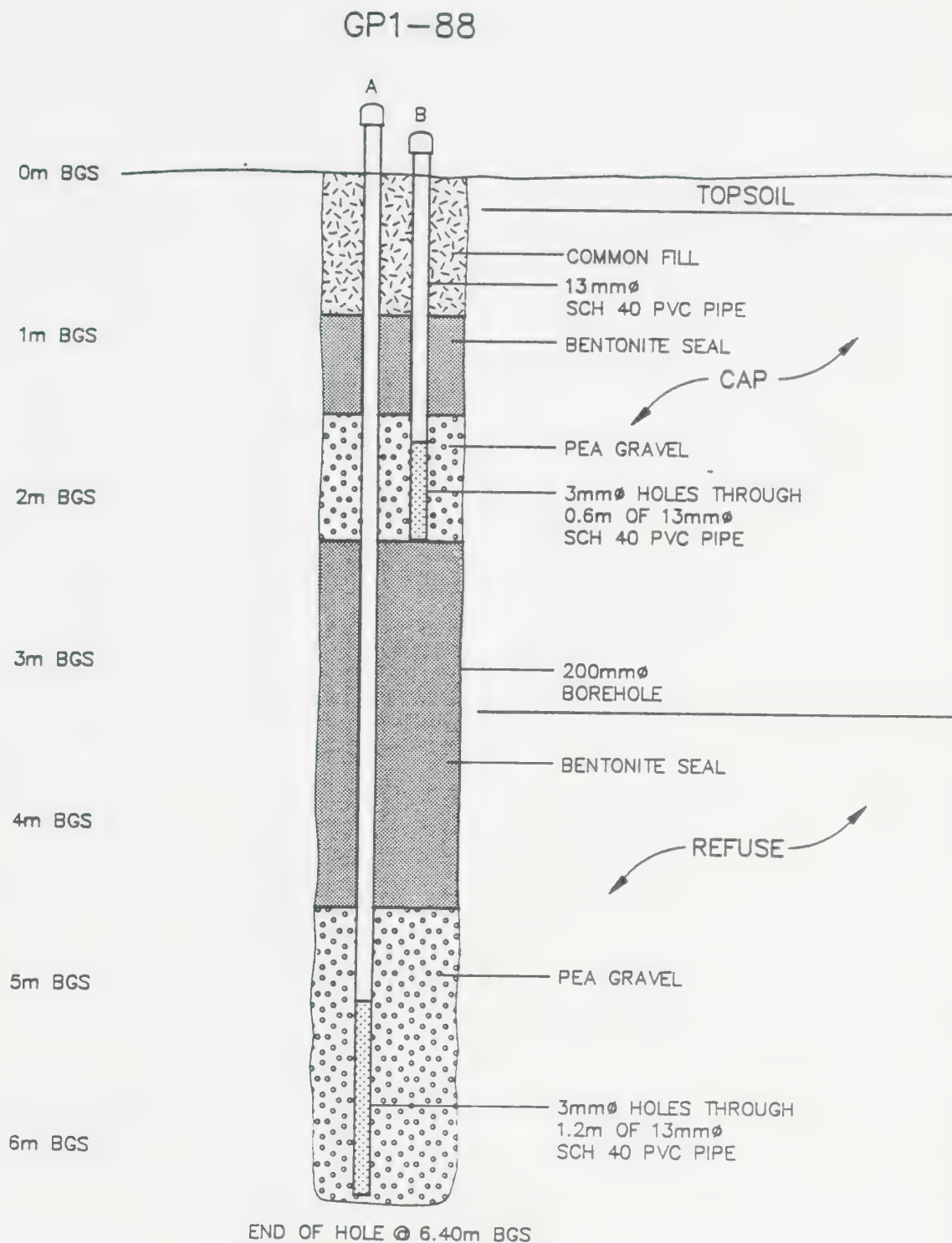


figure A.5

GP1-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

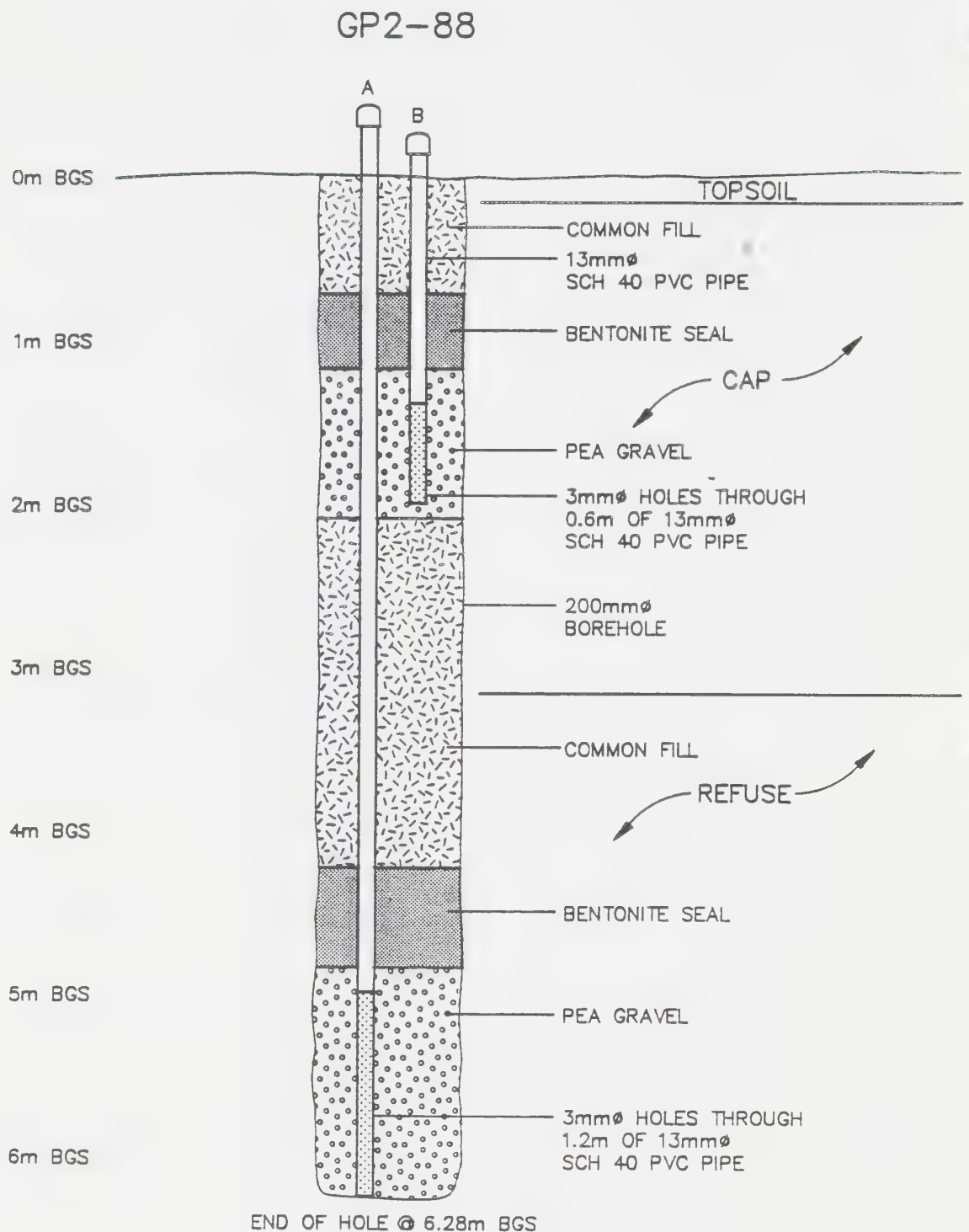


figure A.6

GP2-88

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Regional Municipality of Hamilton-Wentworth

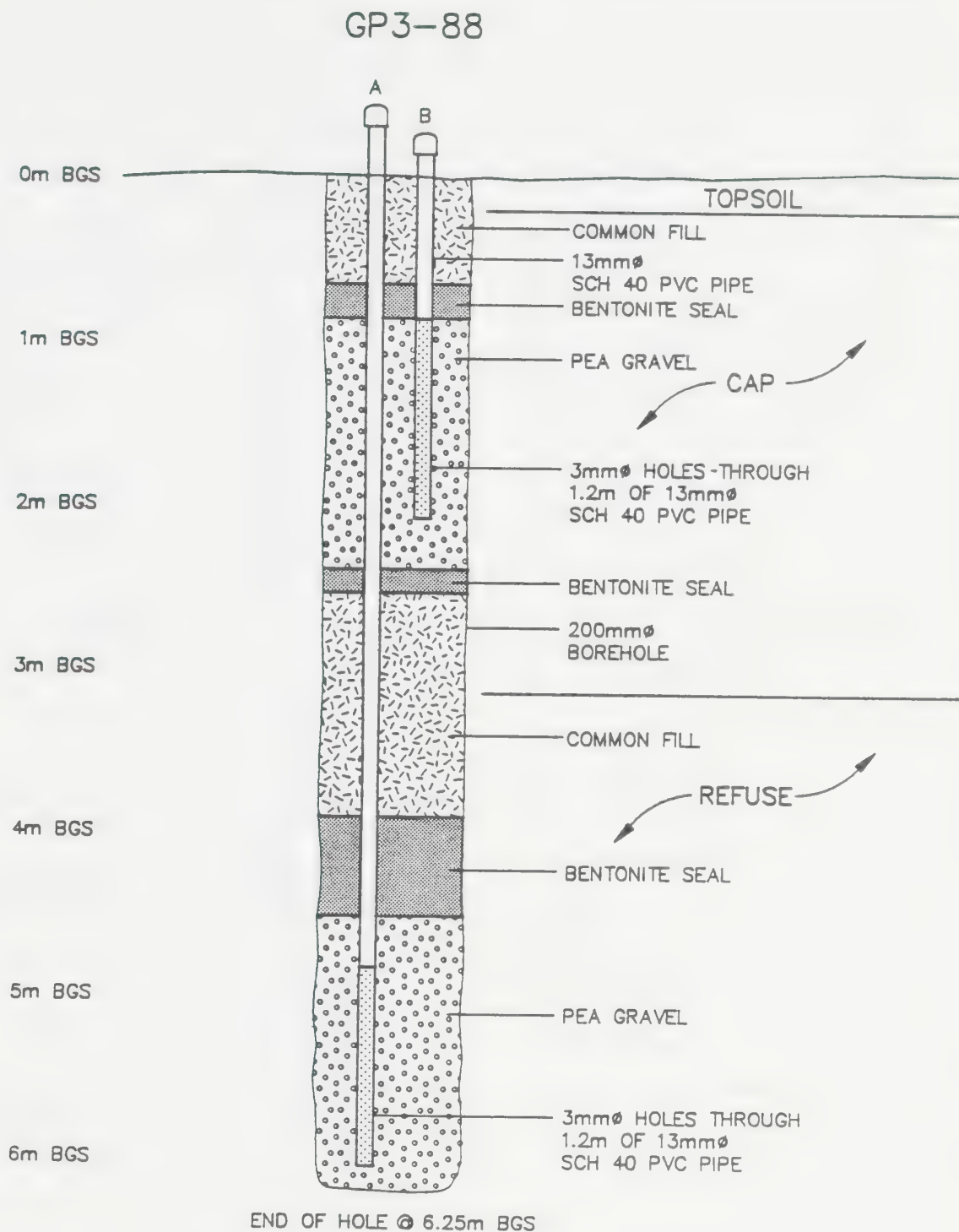


figure A.7

GP3-88
UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

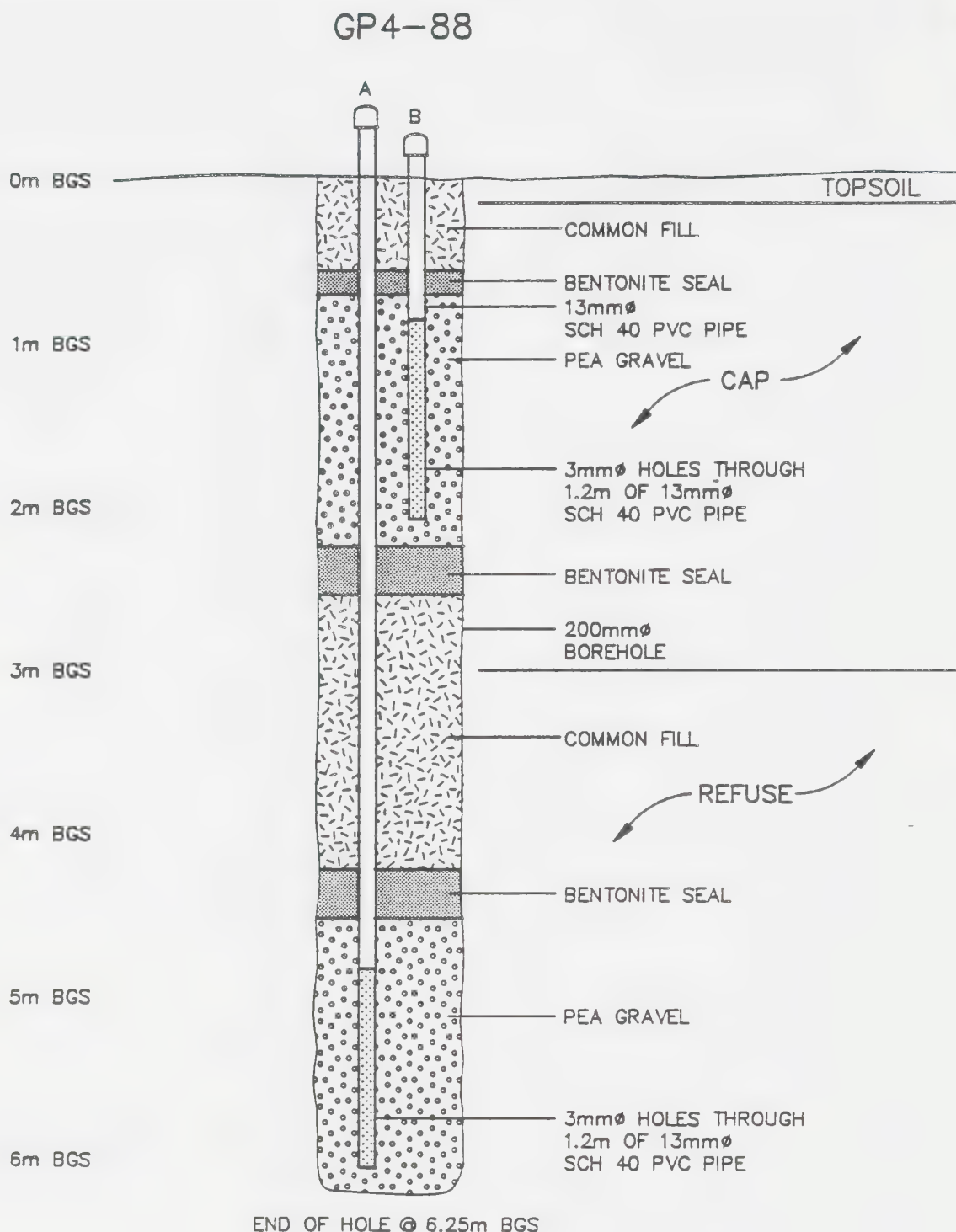


figure A.8

GP4-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

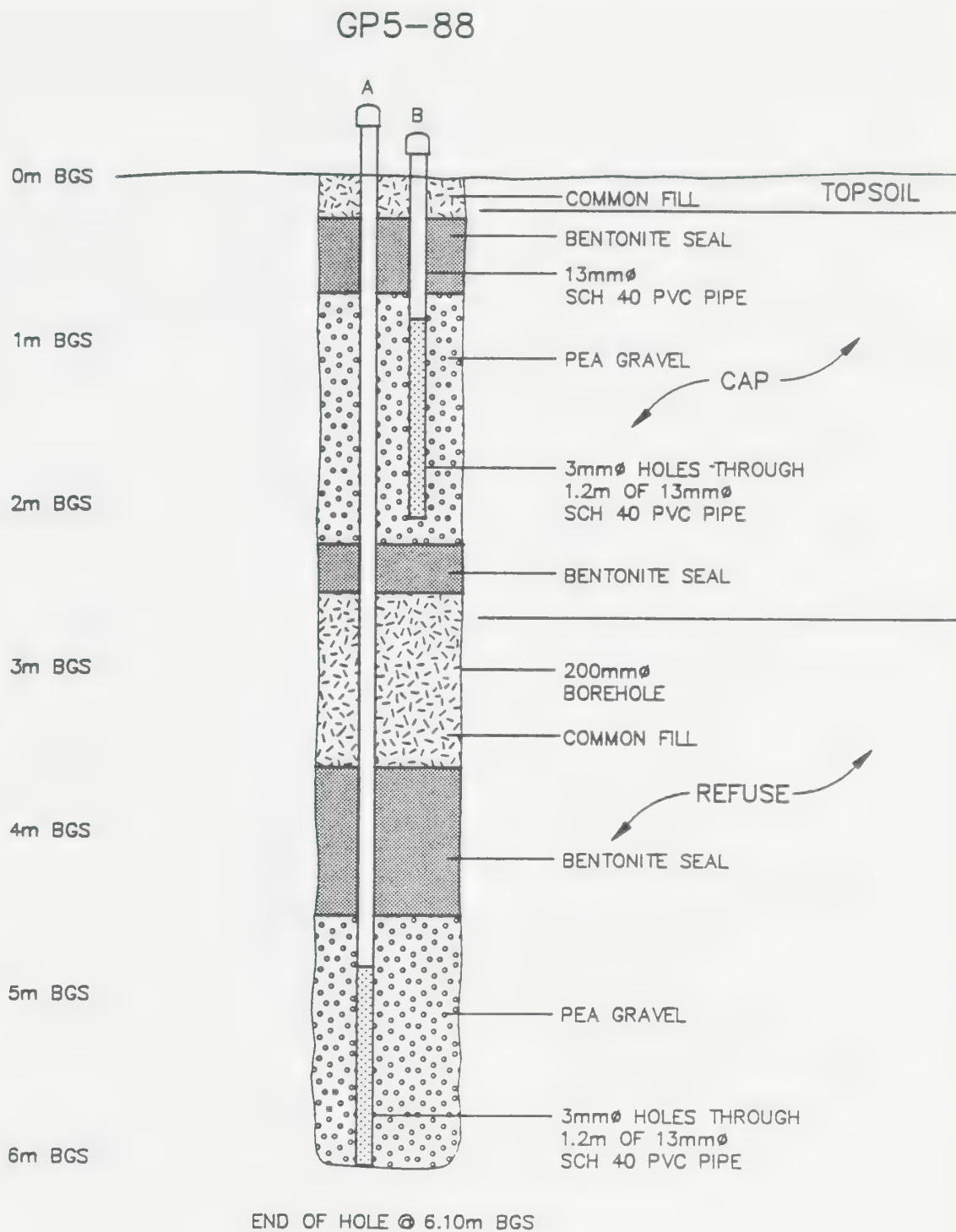


figure A.9

GP5-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

GP6-88

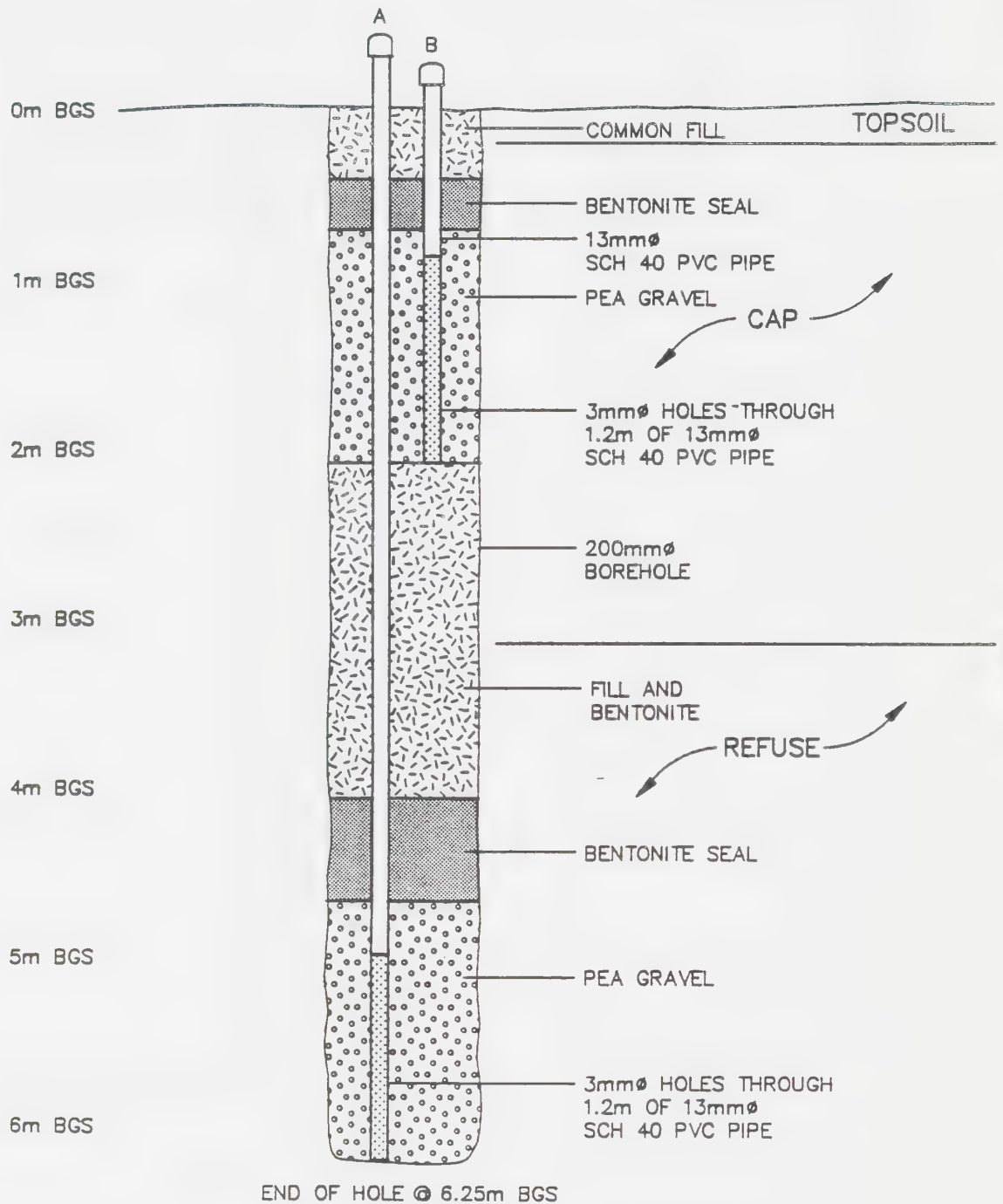


figure A.10

GP6-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

GP11-88

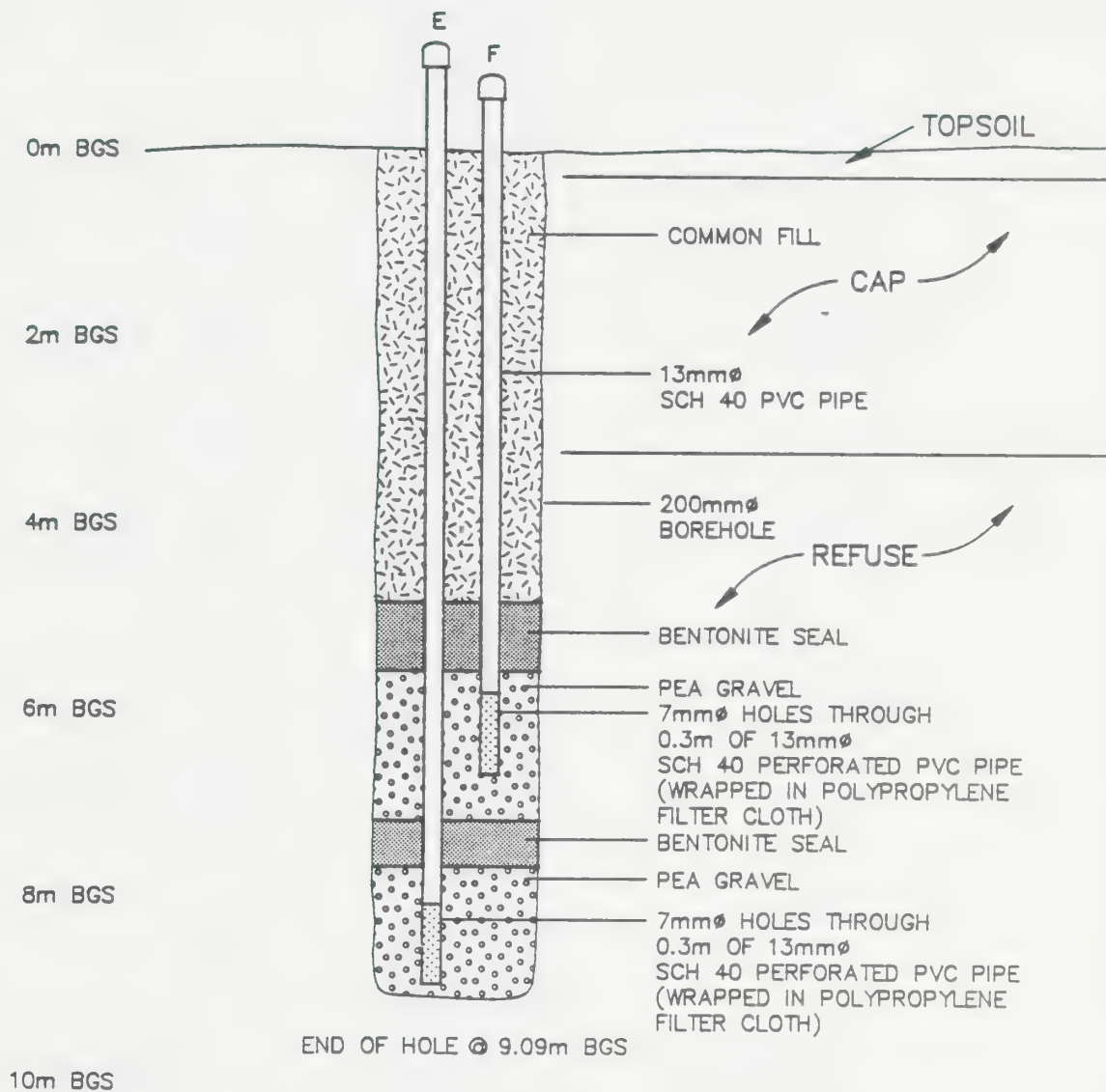


figure A.11

GP11(E-F)-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

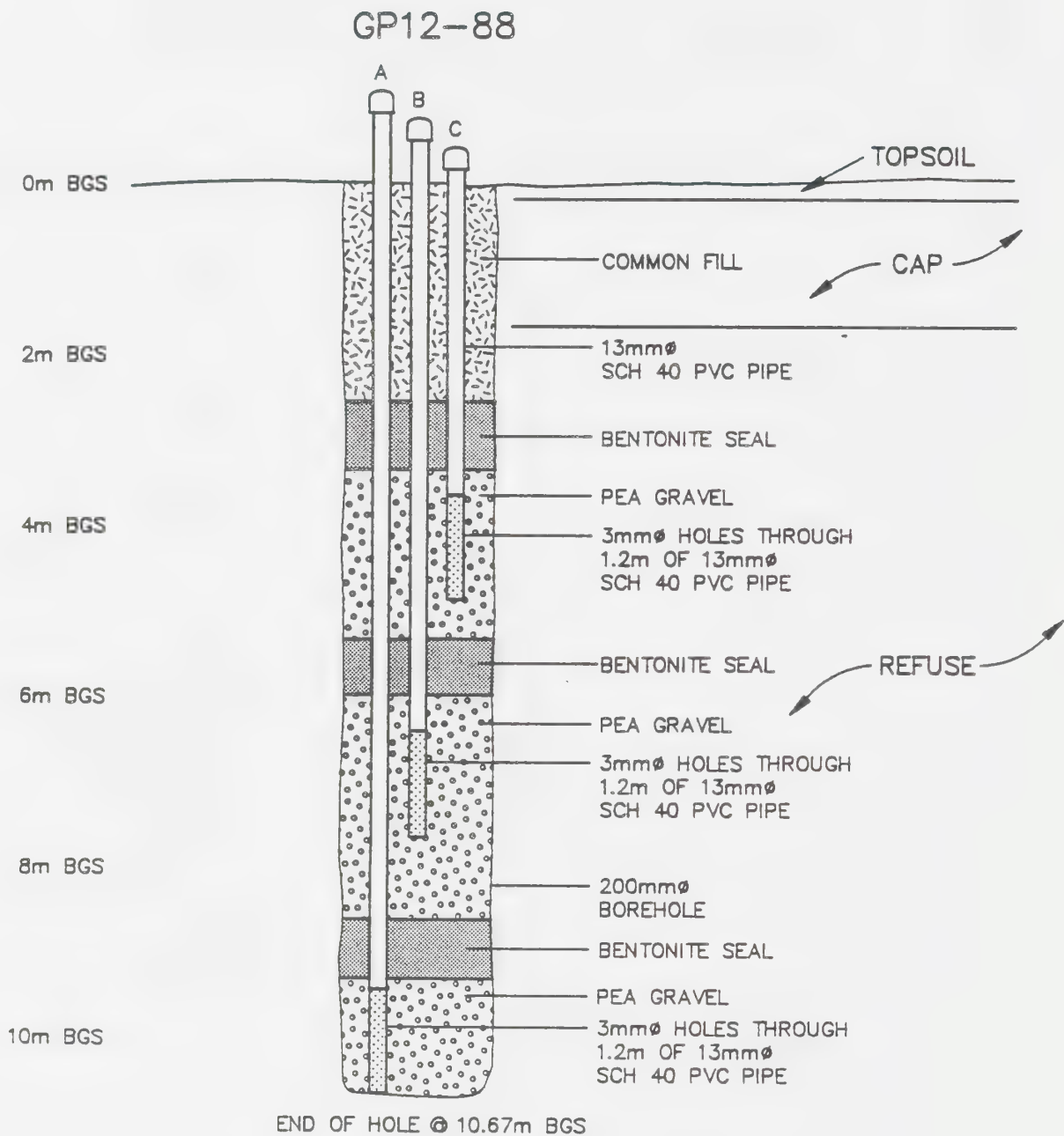


figure A.12

GP12-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

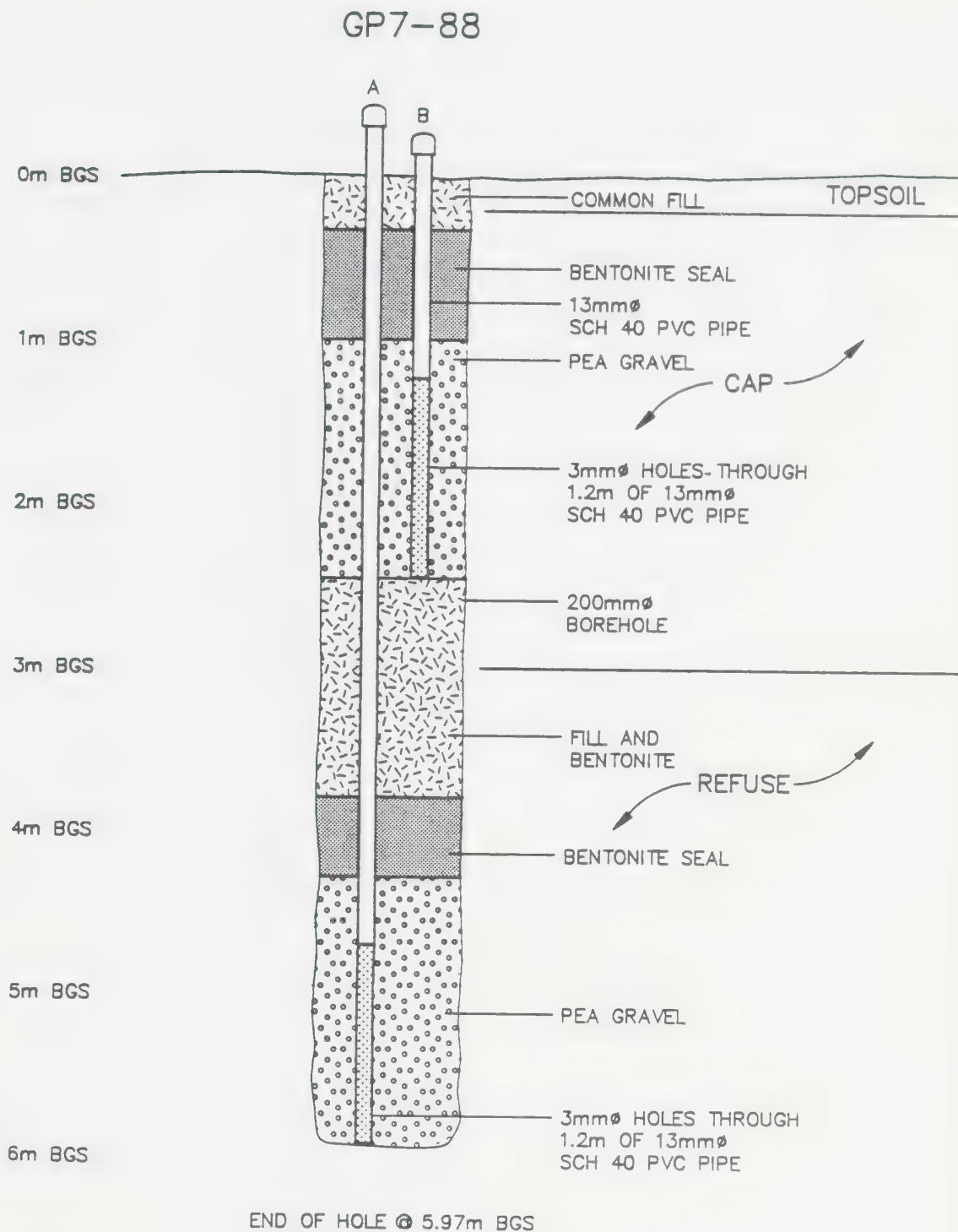


figure A.13

GP7-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

GP8-88

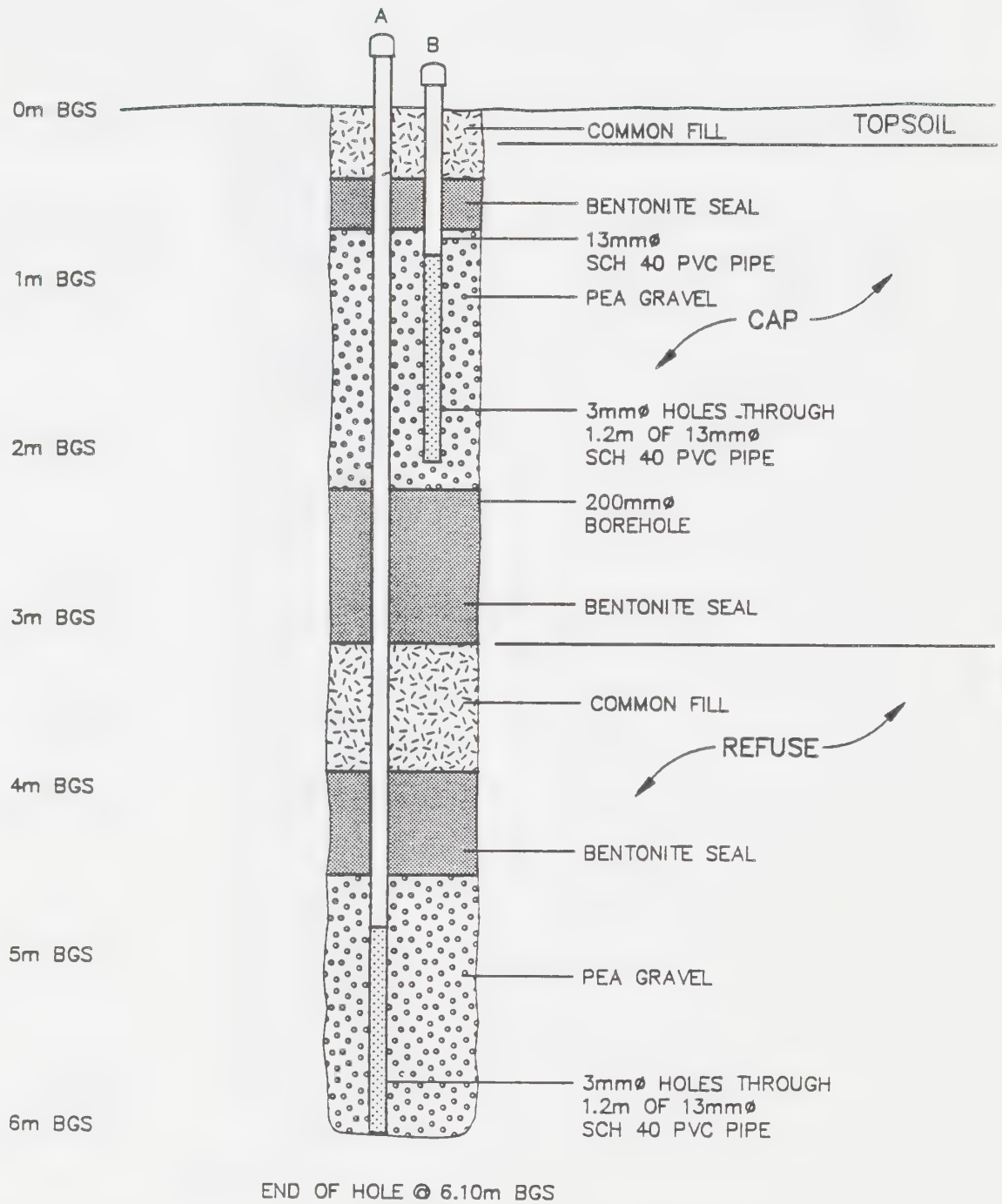


figure A.14

GP8-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

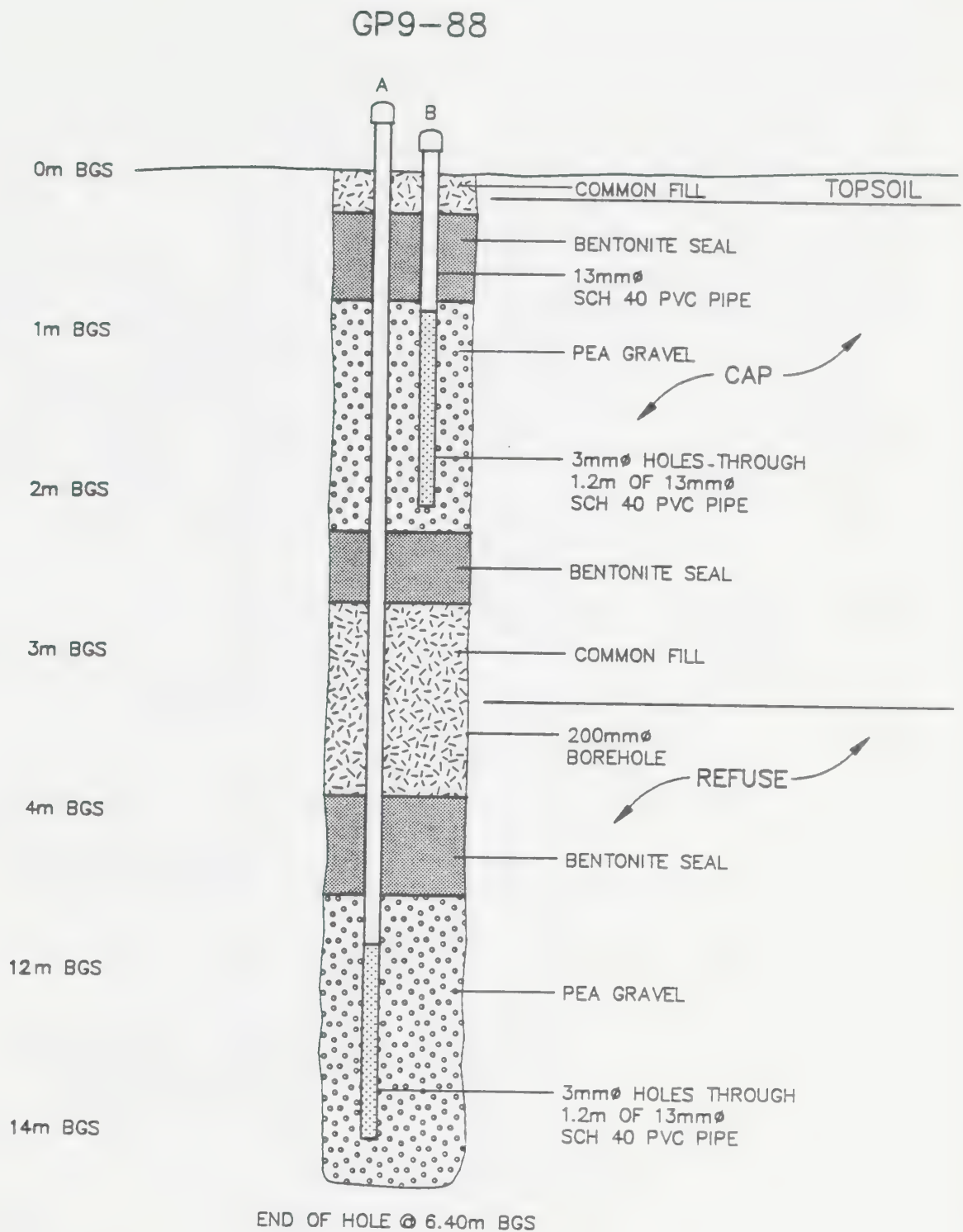


figure A.15

GP9-88
UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

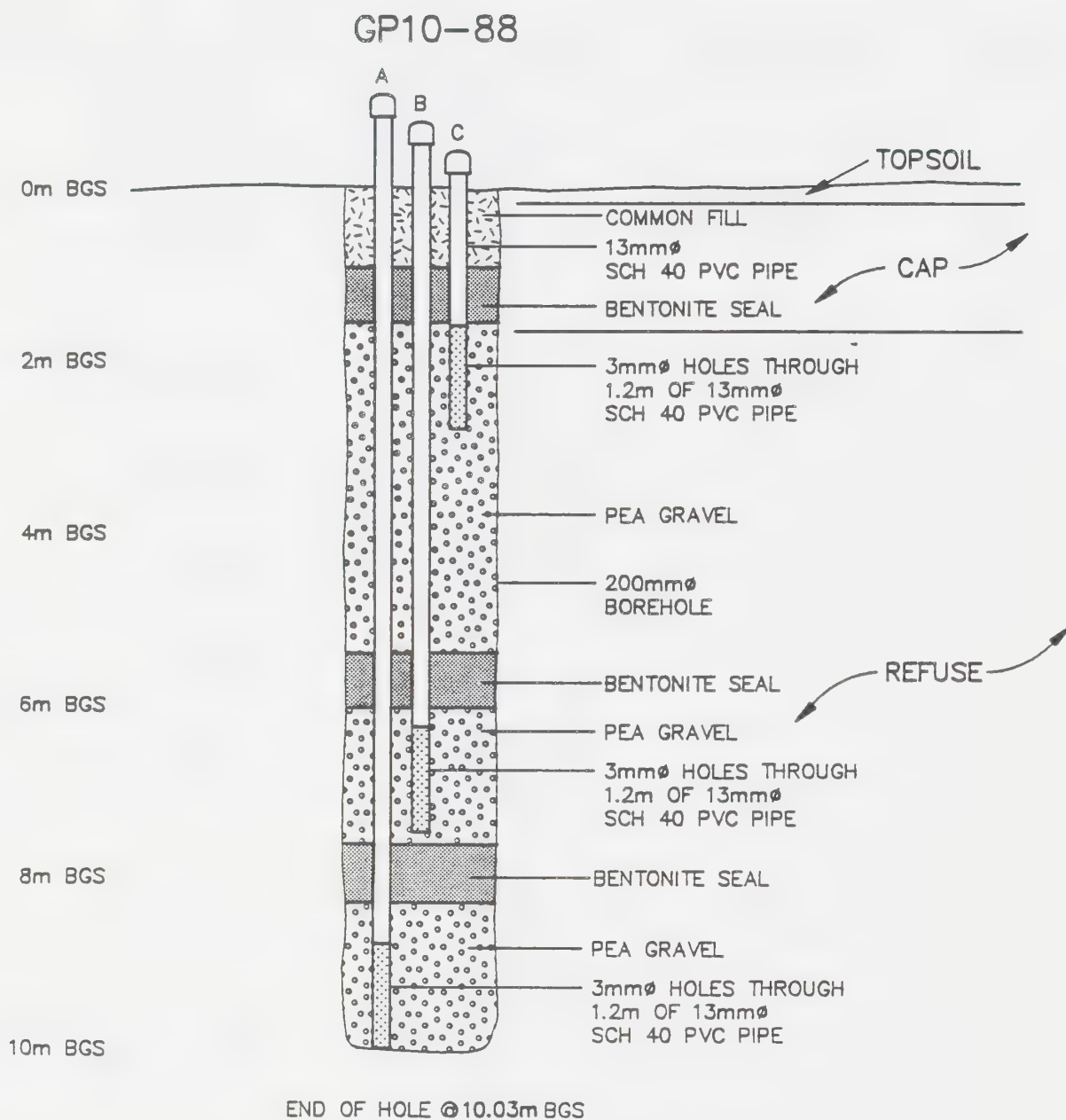


figure A.16

GP10-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

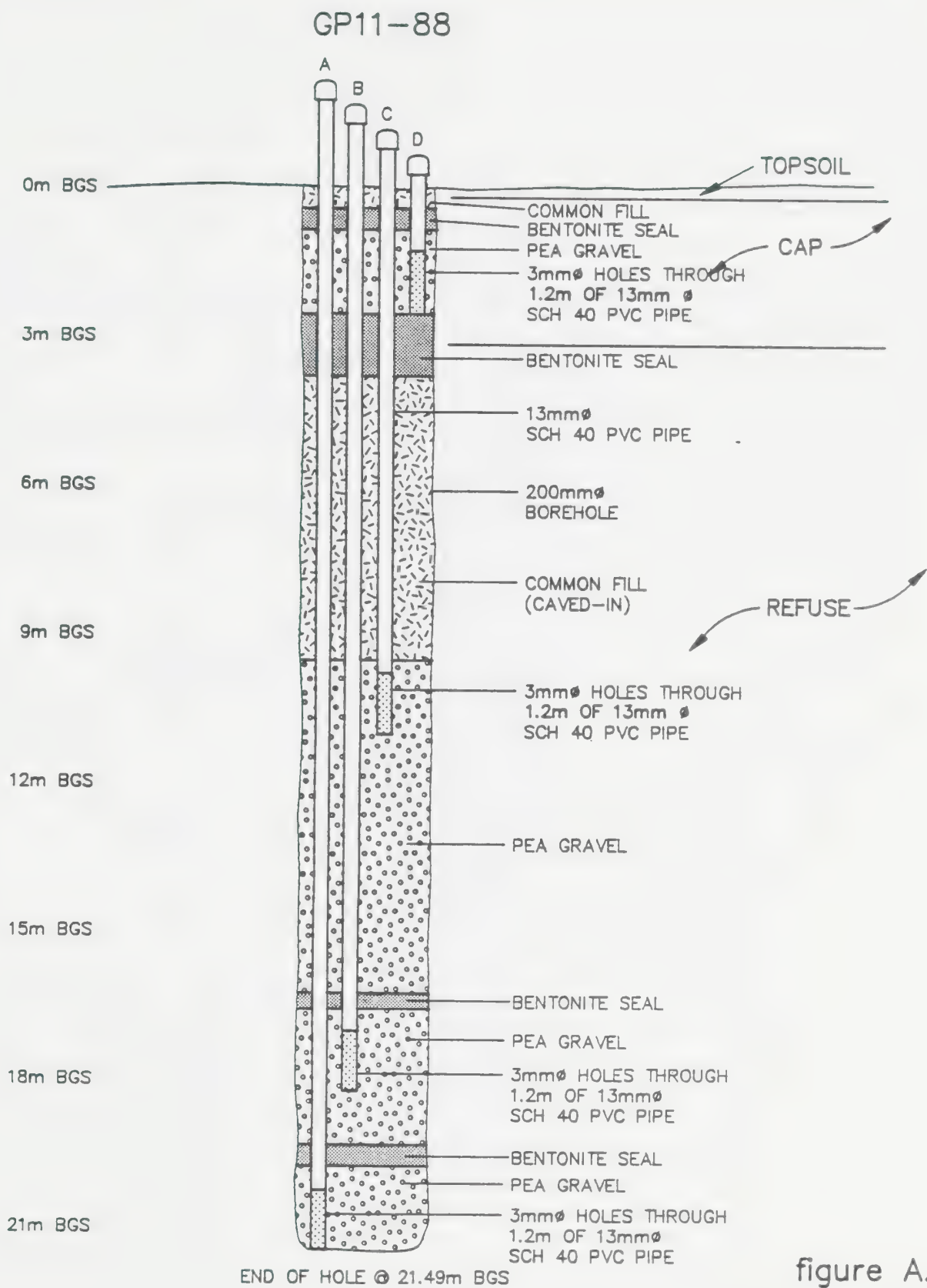


figure A.17

GP11(A-D)-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

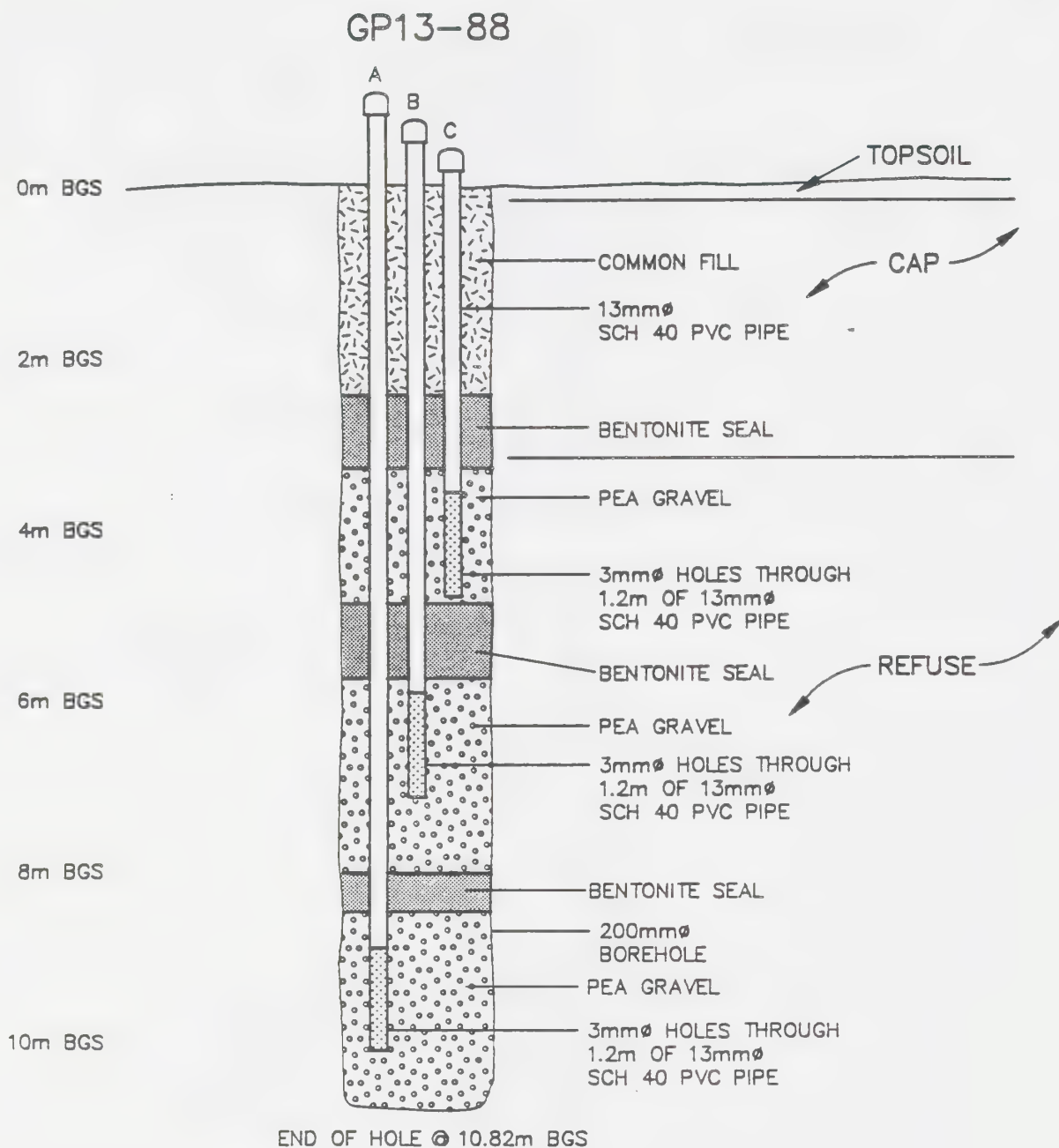


figure A.18

GP13-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

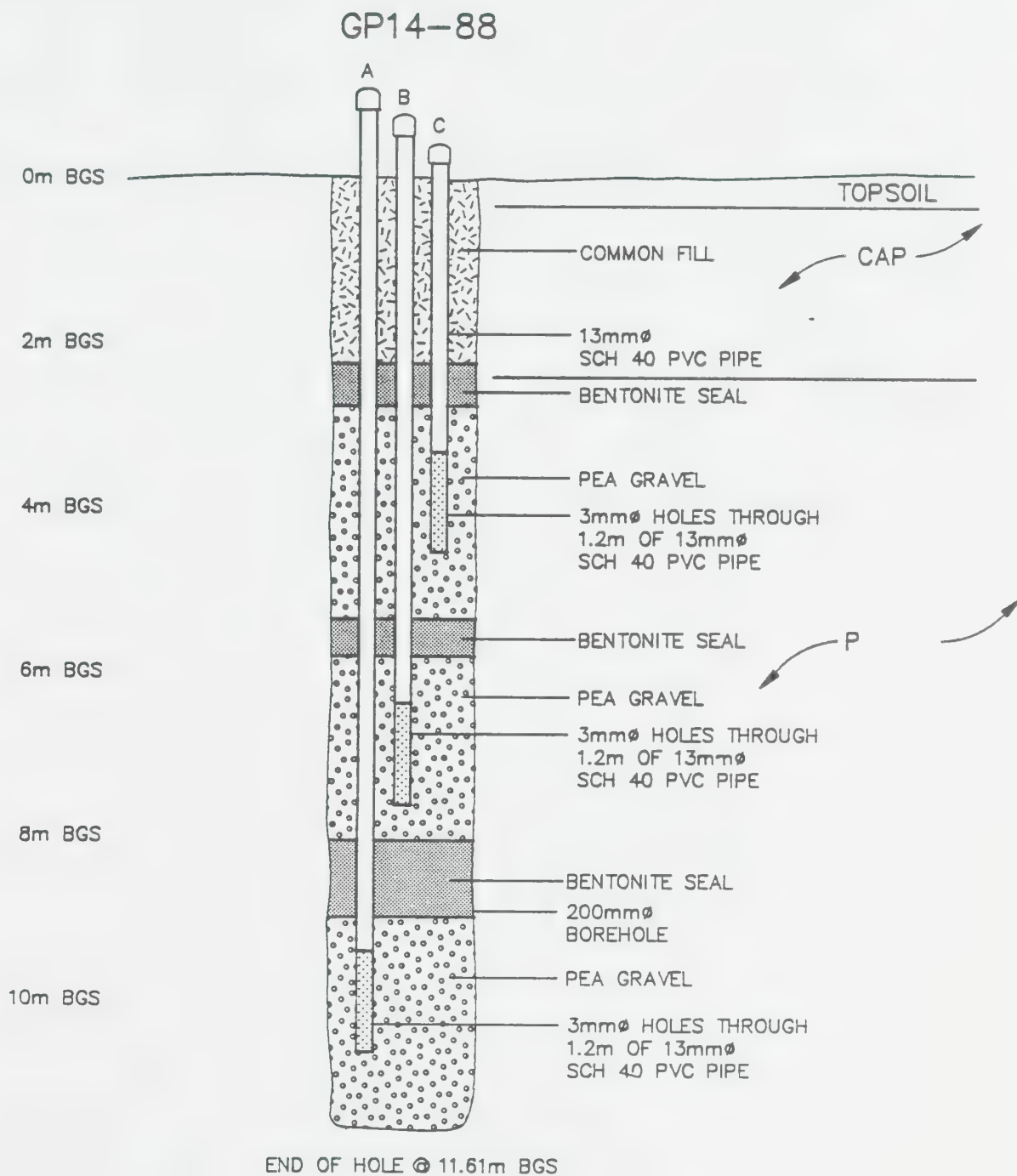


figure A.19

GP14-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

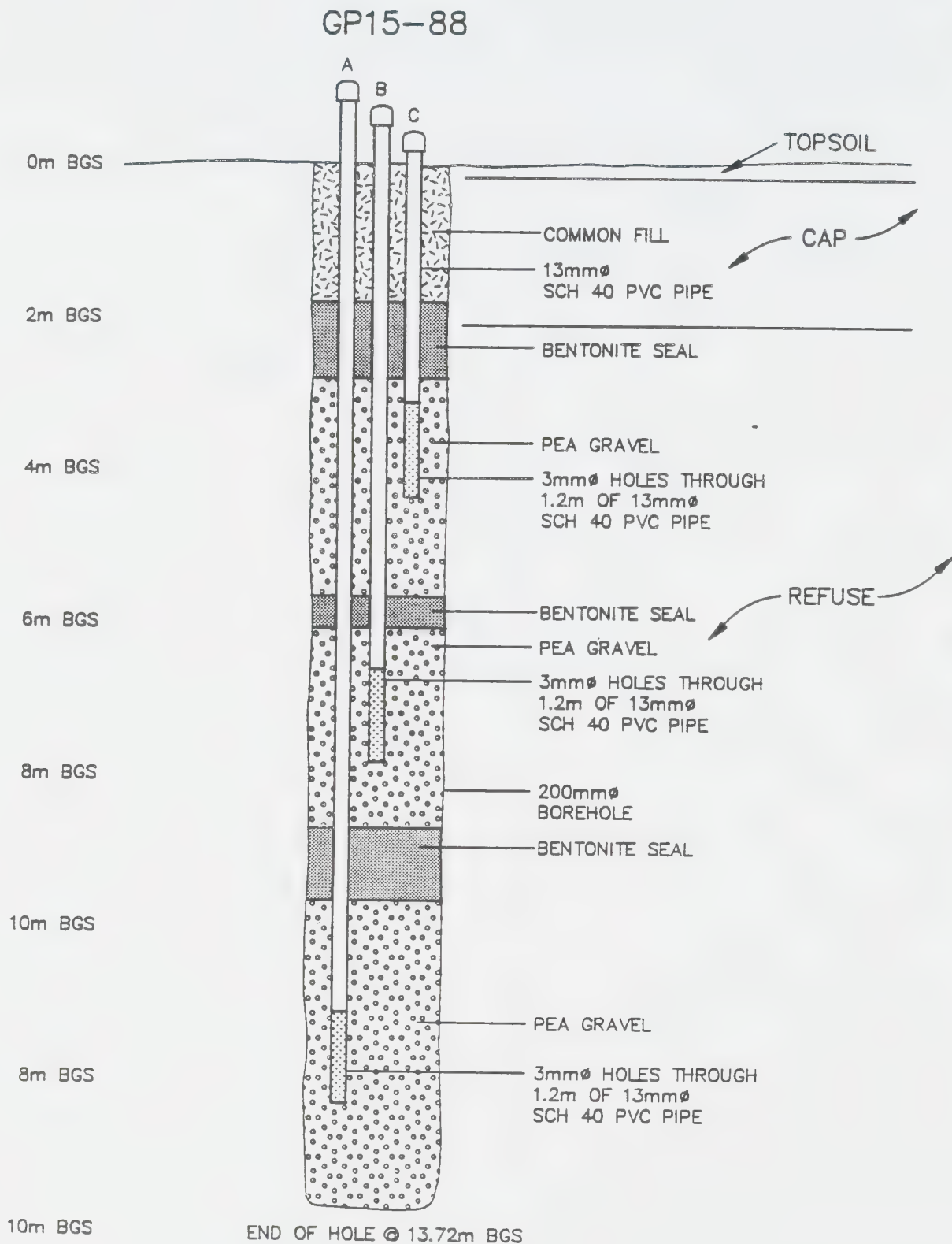


figure A.20

GP15-88
UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

APPENDIX B

ODOUR CONTROL SYSTEM

MONITORING RESULTS

PAGE 1		GP1A-88		GROUND ELEV.: 204.2m AMSL		DEPTH OF SCREEN: 5.1 TO 6.3 (m BGS)		SCREENED ELEVATION: 199.1 TO 197.9 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	14:00	0.2	-	0	408.83	28			
08/03/88	11:05	0.25	-	0	411.24	38.7			
07/04/88	16:00	1	-	-	-	-		- test burn	
09/05/88	10:38	0.75	-	-	405.01	65.66			
09/05/88	13:27	0.35	-	-	404.61	64.76			
09/05/88	13:36	0.53	-	-	404.61	64.76		- system started - 6 cfm per well	
09/05/88	14:01	0.35	-	-	404.61	64.76			
09/05/88	15:20	-	-	59	404.09	67.64			
10/05/88	11:10	0.22	-	50	404.29	61.88			
11/05/88	9:36	0.22	-	40	409.15	49.1			
13/05/88	11:42	0	-	0	406.62	48.56			
16/05/88	15:16	0.55	-	61	404.53	63.3			
18/05/88	12:01	0.05	-	63	409.35	53.78			
18/05/88	13:38	0.4	-	-	409.03	57.38		- system increased to 10.5 cfm per well	
20/05/88	12:17	0.63	-	51	407.42	59.72		- system off for approximately 24 hours	
24/05/88	10:52	0	-	52	405.98	55.2			
25/05/88	10:32	0.08	-	61	408.33	46.9			
25/05/88	11:40	0.02	-	-	408.91	48.38		- system increased to 16.3 cfm per well	
25/05/88	12:21	0.09	-	-	408.91	49.64			
25/05/88	13:56	0	-	61	408.67	53.42			
27/05/88	11:22	0.04	-	54	408.95	71.24			
30/05/88	17:25	0.08	-	62	408.19	87.08			
01/06/88	17:26	0.08	-	63	404.77	75.92			
01/06/88	20:29	0.15	-	-	405.94	59		- system increased to 22 cfm per well	
03/06/88	17:35	0	-	61	407.9	61.88			
05/06/88	13:50	0.18	-	62	406.14	76.28			
08/06/88	17:17	0.05	-	65	406.06	51.8			
16/06/88	-	-	43.2	-	-	-			
20/06/88	-	-	-	-	-	-		- system shutdown and removed from site.	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP1B-88		GROUND ELEV.: 204.2m AMSL		DEPTH OF SCREEN: 1.7 TO 2.3 (m BGS)			
PAGE 1		SCREENED ELEVATION: 202.5 TO 201.9 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.45	-	51	408.83	28	- test burn
08/03/88	11:10	0.45	-	55	411.24	38.7	
07/04/88	16:00	0.3	-	-	-	-	
09/05/88	10:38	0.5	-	-	404.97	64.22	
09/05/88	13:27	0.5	-	-	404.61	64.76	- system started - 6 cfm per well
09/05/88	13:36	0.45	-	-	404.61	64.76	
09/05/88	14:01	0.49	-	-	404.61	64.76	
09/05/88	15:20	-	-	59	404.09	67.64	
10/05/88	11:10	0.33	-	54	404.29	61.88	- system increased to 10.5 cfm per well
11/05/88	9:36	0.3	-	55	409.15	49.1	
13/05/88	11:42	0.25	-	54	406.62	48.56	
16/05/88	15:16	0.55	-	53	404.53	63.3	
18/05/88	12:01	0.33	-	54	409.35	53.78	- system off for approximately 24 hours
18/05/88	13:38	0.5	-	-	409.03	57.38	
20/05/88	12:17	0.4	-	52	407.42	59.72	
24/05/88	10:52	0.3	-	55	405.98	55.2	
25/05/88	10:32	0.36	-	58	408.83	46.9	- system increased to 16.3 cfm per well
25/05/88	11:40	0.25	-	-	408.91	48.38	
25/05/88	12:21	0.27	-	-	408.91	49.64	
25/05/88	13:56	0.3	-	54	408.67	53.42	
27/05/88	11:22	0.27	-	55	408.95	71.24	- system increased to 22 cfm per well
30/05/88	17:25	0.26	-	53	408.19	87.08	
01/06/88	17:26	0.23	-	54	404.77	75.92	
01/06/88	20:29	0.1	-	-	405.94	59	
03/06/88	17:35	0.18	-	53	407.9	61.88	- system shutdown and removed from site.
05/06/88	13:50	0.25	-	52	406.14	76.28	
08/06/88	17:17	0.13	-	55	406.06	51.8	
16/06/88	-	-	21.5	-	-	-	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP 2A-88		GROUND ELEV.: 204.1m AMSL		DEPTH OF SCREEN: 5.0 TO 6.2 (m BGS)	
PAGE 1		SCREENED ELEVATION: 199.1 TO 197.9 (m AMSL)			
DATE	TIME	PRES.	TEMP.	METH.	ATMOS.
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	TEMP. (DEG. F)
04/03/88	14:00	0.6	-	51	28
08/03/88	11:10	0.55	-	54	38.7
07/04/88	16:00	0.35	-	-	-
09/05/88	10:36	0.55	-	-	64.22
09/05/88	13:26	0.58	-	-	64.76
09/05/88	13:35	0.52	-	-	64.61
09/05/88	14:00	0.58	-	-	64.61
09/05/88	15:18	-	-	52	67.64
10/05/88	11:08	0.4	-	56	61.88
11/05/88	9:33	0.35	-	55	49.1
13/05/88	11:40	0.35	-	55	48.56
16/05/88	15:12	0.6	-	53	63.3
18/05/88	11:59	0.48	-	53	53.78
18/05/88	13:36	0.45	-	-	57.38
20/05/88	12:14	0.43	-	52	59.72
24/05/88	10:50	0.37	-	54	55.2
25/05/88	10:30	0.3	-	55	46.9
25/05/88	11:39	0.3	-	-	48.38
25/05/88	12:20	0.28	-	-	49.64
25/05/88	13:52	0.39	-	53	53.42
27/05/88	11:20	0.34	-	54	71.24
30/05/88	17:22	0.25	-	53	87.08
01/06/88	17:23	0.2	-	53	75.92
01/06/88	20:27	0.16	-	-	59
03/06/88	17:33	0.2	-	53	61.88
05/06/88	13:47	0.33	-	51	76.28
08/06/88	17:14	0.17	-	55	51.8
16/06/88	-	-	41.7	-	-
20/06/88	-	-	-	-	-
- test burn - system started - 6 cfm per well - system increased to 10.5 cfm per well - system off for approximately 24 hours - system increased to 16.3 cfm per well - system increased to 22 cfm per well - system shutdown and removed from site.					

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 2 B-88		GROUND ELEV.: 204.1m AMSL		DEPTH OF SCREEN: 1.4 TO 2.0 (m BGS)		SCREENED ELEVATION: 202.7 TO 202.1 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	14:00	0.35	-	56	408.83	28			
08/03/88	11:13	0.35	-	58	411.24	38.7			
07/04/88	16:00	0.25	-	-	-	-		- test burn	
09/05/88	10:36	0.5	-	-	404.97	64.22			
09/05/88	13:26	0.55	-	-	404.61	64.76			
09/05/88	13:35	0.52	-	-	404.61	64.76		- system started - 6 cfm per well	
09/05/88	14:00	0.49	-	-	404.61	64.76			
09/05/88	15:18	-	-	52	404.09	67.64			
10/05/88	11:08	0.32	-	53	404.29	61.88			
11/05/88	9:33	0.3	-	55	409.15	49.1			
13/05/88	11:40	0.26	-	52	406.62	48.56			
16/05/88	15:12	0.55	-	52	404.53	63.3			
18/05/88	11:59	0.35	-	53	409.35	53.78			
18/05/88	13:36	0.4	-	-	409.03	57.38		- system increased to 10.5 cfm per well	
20/05/88	12:14	0.38	-	52	407.42	59.72		- system off for approximately 24 hours	
24/05/88	10:50	0.31	-	55	405.98	55.2			
25/05/88	10:30	0.26	-	55	408.83	46.9			
25/05/88	11:39	0.24	-	-	408.91	48.38		- system increased to 16.3 cfm per well	
25/05/88	12:20	0.25	-	-	408.91	49.64			
25/05/88	13:52	0.33	-	53	408.67	53.42			
27/05/88	11:20	0.27	-	55	408.95	71.24			
30/05/88	17:22	0.25	-	52	408.19	87.08			
01/06/88	17:23	0.18	-	53	404.77	75.92			
01/06/88	20:27	0.1	-	-	405.94	59		- system increased to 22 cfm per well	
03/06/88	17:33	0.17	-	56	407.9	61.88			
05/06/88	13:47	0.27	-	52	406.14	76.28			
08/06/88	17:14	0.12	-	55	406.06	51.8			
16/06/88	-	-	23.8	-	-	-			
20/06/88	-	-	-	-	-	-		- system shutdown and removed from site.	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP3A-88		GROUND ELEV.: 204.0m AMSL		DEPTH OF SCREEN: 4.9 TO 6.1 (m BGS)			
PAGE 1		SCREENED ELEVATION: 199.1 TO 197.9 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.8	-	50	408.83	28	- test burn
08/03/88	11:14	0.75	-	53	411.24	38.7	
04/07/88	16:00	0.3	-	-	-	-	
09/05/88	10:34	0.7	-	-	404.97	64.22	
09/05/88	13:25	0.72	-	-	404.61	64.76	- system started - 6 cfm per well
09/05/88	13:34	0.62	-	-	404.61	64.76	
09/05/88	13:59	0.63	-	-	404.61	64.76	
09/05/88	15:16	-	-	52	404.09	67.64	
10/05/88	11:06	0.4	-	52	404.29	61.88	- system increased to 10.5 cfm per well - system off for approximately 24 hours
11/05/88	9:30	0.4	-	55	409.15	49.1	
13/05/88	11:38	0.35	-	54	406.62	48.56	
16/05/88	15:09	0.62	-	52	404.53	63.3	
18/05/88	11:57	0.55	-	53	409.35	53.78	- system increased to 16.3 cfm per well
18/05/88	13:34	0.52	-	-	409.03	57.38	
20/05/88	12:12	0.48	-	51	407.42	59.72	
24/05/88	10:48	0.38	-	54	405.98	55.2	
25/05/88	10:28	0.37	-	54	408.83	46.9	- system increased to 22 cfm per well
25/05/88	11:38	0.33	-	-	408.91	48.38	
25/05/88	12:19	0.34	-	-	408.91	49.64	
25/05/88	13:50	0.34	-	53	408.67	53.42	
27/05/88	11:17	0.37	-	55	408.95	71.24	- system shutdown and removed from site.
30/05/88	17:19	0.33	-	53	408.19	87.08	
01/06/88	17:20	0.27	-	53	404.77	75.92	
01/06/88	20:26	0.18	-	-	405.94	59	
03/06/88	17:31	0.27	-	52	407.9	61.88	
05/06/88	13:44	0.37	-	52	406.14	76.28	
08/06/88	17:12	0.16	-	54	406.06	51.8	
16/06/88	-	-	44.1	-	-	-	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP3B-88		GROUND ELEV.: 204.0m AMSL		DEPTH OF SCREEN: 0.9 TO 2.1 (m BGS)		SCREENED ELEVATION: 203.1 TO 201.9 (m AMSL)	
PAGE 1	DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.
(D/M/Y)			(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)
04/03/88	14:00		0.38	-	52	408.83	28
08/03/88	11:15		0.35	-	55	411.24	38.7
07/04/88	16:00		0.05	-	-	-	-
09/05/88	10:34		0.4	-	-	404.97	64.22
09/05/88	13:25		0.4	-	-	404.61	64.76
09/05/88	13:34		0.3	-	-	404.61	64.76
09/05/88	13:59		0.29	-	-	404.61	64.76
09/05/88	15:16		-	-	54	404.09	67.64
10/05/88	11:06		0.18	-	56	404.29	61.88
11/05/88	9:28		0.12	-	52	409.15	49.1
13/05/88	11:38		0.15	-	57	406.62	48.56
16/05/88	15:09		0.37	-	56	404.53	63.3
18/05/88	11:57		0.27	-	57	409.35	53.78
18/05/88	13:34		0.25	-	-	409.03	57.38
20/05/88	12:12		0.24	-	54	407.42	59.72
24/05/88	10:48		0.17	-	60	405.98	55.2
25/05/88	10:28		0.18	-	60	408.83	46.9
25/05/88	11:38		0.1	-	-	408.91	48.38
25/05/88	12:19		0.08	-	-	408.91	49.64
25/05/88	13:50		0.14	-	58	408.67	53.42
27/05/88	11:17		0.12	-	63	408.95	71.24
30/05/88	17:19		0.13	-	60	408.19	87.08
01/06/88	17:20		0.07	-	60	404.77	75.92
01/06/88	20:26		0	-	-	405.94	59
03/06/88	17:31		0.07	-	57	407.9	61.88
05/06/88	13:44		0.12	-	61	406.14	76.28
08/06/88	17:12		0	-	66	406.06	51.8
16/06/88	-		-	23.2	-	-	-
20/06/88	-		-	-	-	-	-
			- test burn				
			- system started - 6 cfm per well				
			- system increased to 10.5 cfm per well				
			- system off for approximately 24 hours				
			- system increased to 16.3 cfm per well				
			- system increased to 22 cfm per well				
			- system shutdown and removed from site.				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 4 A-88		GROUND ELEV.: 204.0m AMSL		DEPTH OF SCREEN: 4.9 TO 6.1 (m BGS)		SCREENED ELEVATION: 199.1 TO 197.9 (m BGS)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	14:00	0.25	-	52	408.83	28	- test burn		
08/03/88	11:17	0.2	-	54	411.24	38.7			
07/04/88	16:00	0	-	-	-	-			
09/05/88	10:32	0.4	-	-	404.97	64.22	- system started - 6 cfm per well		
09/05/88	13:24	0.38	-	-	404.61	64.76			
09/05/88	13:34	0.3	-	-	404.61	64.76			
09/05/88	13:58	0.22	-	-	404.61	64.76	- system increased to 10.5 cfm per well		
09/05/88	15:15	-	-	54	404.09	67.64			
10/05/88	11:04	0.15	-	54	404.29	61.88			
11/05/88	9:28	0.23	-	54	409.15	49.1	- system increased to 10.5 cfm per well		
13/05/88	11:36	0.08	-	55	406.62	48.56			
16/05/88	15:06	0.35	-	52	404.53	63.3			
18/05/88	11:55	0.2	-	54	409.35	53.78	- system off for approximately 24 hours		
18/05/88	13:33	0.2	-	-	409.03	57.38			
18/05/88	14:26	0.2	-	-	409.03	57.38			
20/05/88	12:11	0.19	-	53	407.42	59.72	- system increased to 16.3 cfm per well		
24/05/88	10:46	0.12	-	56	405.98	55.2			
25/05/88	10:26	0.1	-	55	408.83	46.9			
25/05/88	11:37	0.03	-	-	408.91	48.38	- system increased to 22 cfm per well		
25/05/88	12:17	0.04	-	-	408.91	49.64			
25/05/88	13:47	0.05	-	54	408.67	53.42			
27/05/88	11:13	0.05	-	55	408.95	71.24	- system increased to 22 cfm per well		
30/05/88	17:17	0.03	-	53	408.19	87.08			
01/06/88	17:17	0.02	-	53	404.77	75.92			
01/06/88	20:25	-0.1	-	-	405.94	59	- system shutdown and removed from site.		
03/06/88	17:27	0	-	52	407.9	61.88			
05/06/88	13:41	0.05	-	51	406.14	76.28			
08/06/88	17:09	-0.02	-	53	406.06	51.8	- system shutdown and removed from site.		
16/06/88	-	-	23	-	-	-			
20/06/88	-	-	-	-	-	-			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 4 B - 88		GROUND ELEV.: 204.0m AMSL		DEPTH OF SCREEN: 0.9 TO 2.1 (m BGS)		SCREENED ELEVATION: 203.1 TO 201.9 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O) (DEG. F)	(DEG. F)			
04/03/88	14:00	0.75	-	51	408.83	28			
08/03/88	11:20	0.7	-	54	411.24	38.7			
07/04/88	16:00	0	-	-	-	-	- test burn		
09/05/88	10:32	0.75	-	-	404.97	64.22			
09/05/88	13:24	0.68	-	-	404.61	64.76			
09/05/88	13:34	0.47	-	-	404.61	64.76	- system started - 6 cfm per well		
09/05/88	13:58	0.43	-	-	404.61	64.76			
09/05/88	15:15	-	-	54	404.09	67.64			
10/05/88	11:04	0.27	-	54	404.29	61.88			
11/05/88	9:28	0.23	-	54	409.15	49.1			
13/05/88	11:36	0.22	-	56	406.62	48.56			
16/05/88	15:06	0.53	-	54	404.53	63.3			
18/05/88	11:55	0.35	-	54	409.35	53.78			
18/05/88	13:33	0.34	-	-	409.03	57.38	- system increased to 10.5 cfm per well		
18/05/88	14:26	0.3	-	-	409.03	57.38	- system off for approximately 24 hours		
20/05/88	12:11	0.3	-	53	407.42	59.72			
24/05/88	10:46	0.23	-	57	405.98	55.2			
25/05/88	10:26	0.19	-	56	408.83	46.9	- system increased to 16.3 cfm per well		
25/05/88	11:37	0.08	-	-	408.91	48.38			
25/05/88	12:17	0.12	-	-	408.91	49.64			
25/05/88	13:47	0.15	-	55	408.67	53.42			
27/05/88	11:13	0.15	-	57	408.95	71.24			
30/05/88	17:17	0.12	-	54	408.19	87.08			
01/06/88	17:17	0.07	-	54	404.77	75.92			
01/06/88	20:25	-0.06	-	-	405.94	59	- system increased to 22 cfm per well		
03/06/88	17:27	0.05	-	54	407.9	61.88			
05/06/88	13:41	0.17	-	53	406.14	76.28			
08/06/88	17:09	-0.07	-	57	406.06	51.8			
16/06/88	-	-	41	-	-	-			
20/06/88	-	-	-	-	-	-	- system shutdown and removed from site.		

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP5A-88		GROUND ELEV.: 204.5m AMSL		DEPTH OF SCREEN: 4.9 TO 6.1 (m BGS)		SCREENED ELEVATION: 199.6 TO 198.4 (m AMSL)	
PAGE 1							
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.65	-	51	408.83	28	- test burn
08/03/88	11:20	0.5	-	54	411.24	38.7	
07/04/88	16:00	0.5	-	-	-	-	
09/05/88	10:30	0.65	-	-	404.97	64.22	
09/05/88	13:23	0.61	-	-	404.61	64.76	- system started - 6 cfm per well
09/05/88	13:33	0.48	-	-	404.61	64.76	
09/05/88	13:57	0.4	-	-	404.61	64.76	
09/05/88	15:09	-	-	53	404.09	67.64	
10/05/88	11:00	0.33	-	53	404.29	61.88	- system increased to 10.5 cfm per well - system off for approximately 24 hours
11/05/88	9:22	0.29	-	52	409.15	49.1	
13/05/88	11:35	0.27	-	54	406.62	48.56	
16/05/88	15:03	0.37	-	52	404.53	63.3	
18/05/88	11:51	0.36	-	53	409.35	53.78	- system increased to 16.3 cfm per well
18/05/88	13:30	0.34	-	-	409.03	57.38	
18/05/88	14:23	0.32	-	-	409.03	57.38	
20/05/88	12:08	0.34	-	52	407.42	59.72	
24/05/88	10:43	0.27	-	56	405.98	55.2	- system increased to 22 cfm per well
25/05/88	10:22	0.25	-	52	408.83	46.9	
25/05/88	11:35	0.17	-	-	408.91	48.38	
25/05/88	12:15	0.14	-	-	408.91	49.64	
25/05/88	13:42	0.17	-	53	408.67	53.42	- system shutdown and removed from site.
27/05/88	11:07	0.2	-	52	408.95	71.24	
30/05/88	17:11	0.15	-	52	408.19	87.08	
01/06/88	17:11	0.12	-	52	404.77	75.92	
01/06/88	20:23	-0.06	-	-	405.94	59	- system shutdown and removed from site.
03/06/88	17:22	0.05	-	52	407.9	61.88	
05/06/88	13:37	0.17	-	53	406.14	76.28	
08/06/88	17:04	-0.02	-	54	406.06	51.8	
16/06/88	-	-	43	-	-	-	- system shutdown and removed from site.
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP 5 B - 88		GROUND ELEV.: 204.5m AMSL		DEPTH OF SCREEN: 0.9 TO 2.1 (m BGS)			
PAGE 1		SCREENED ELEVATION: 203.6 TO 202.4 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.4	-	52	408.83	28	- test burn
08/03/88	11:22	0.25	-	54	411.24	38.7	
07/04/88	16:00	-0.05	-	-	-	-	
09/05/88	10:30	0.4	-	-	404.97	64.22	- system started - 6 cfm per well
09/05/88	13:23	0.42	-	-	404.61	64.76	
09/05/88	13:33	0.28	-	-	404.61	64.76	
09/05/88	13:57	0.2	-	-	404.61	64.76	
09/05/88	15:09	-	-	56	404.09	67.64	
10/05/88	11:00	0.15	-	56	404.29	61.88	
11/05/88	9:22	0.1	-	55	409.15	49.1	- system increased to 10.5 cfm per well - system off for approximately 24 hours
13/05/88	11:35	0.08	-	58	406.62	48.56	
16/05/88	15:03	0.25	-	54	404.53	63.3	
18/05/88	11:51	0.16	-	56	409.35	53.78	- system increased to 16.3 cfm per well
18/05/88	13:30	0.15	-	-	409.03	57.38	
18/05/88	14:23	0.15	-	-	409.03	57.38	
20/05/88	12:08	0.15	-	55	407.42	59.72	
24/05/88	10:43	0.08	-	59	405.98	55.2	
25/05/88	10:22	0.08	-	58	408.83	46.9	
25/05/88	11:35	0	-	-	408.91	48.38	- system increased to 22 cfm per well
25/05/88	12:15	0	-	-	408.91	49.64	
25/05/88	13:42	0	-	56	408.67	53.42	
27/05/88	11:07	0.03	-	54	408.95	71.24	
30/05/88	17:11	-0.03	-	47	408.19	87.08	
01/06/88	17:11	-0.06	-	49	404.77	75.92	
01/06/88	20:23	-0.19	-	-	405.94	59	- system shutdown and removed from site.
03/06/88	17:22	-0.1	-	40	407.9	61.88	
05/06/88	13:37	-0.03	-	20	406.14	76.28	
08/06/88	17:04	-0.13	-	14	406.06	51.8	
16/06/88	-	-	22	-	-	-	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP6A-88		GROUND ELEV.: 205.0m AMSL		DEPTH OF SCREEN: 5.0 TO 6.2 (m BGS)		SCREENED ELEVATION: 200.0 TO 198.8 (m AMSL)	
PAGE 1							
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.4	-	52	408.83	28	- test burn
08/03/88	11:24	0.4	-	53	411.24	38.7	
07/04/88	16:00	0	-	-	-	-	
09/05/88	10:27	0.5	-	-	404.97	64.22	- system started - 6 cfm per well
09/05/88	13:21	0.51	-	-	404.61	64.76	
09/05/88	13:32	0.35	-	-	404.61	64.76	
09/05/88	13:54	0.23	-	-	404.61	64.76	- system increased to 10.5 cfm per well - system off for approximately 24 hours
09/05/88	15:03	-	-	53	404.09	67.64	
10/05/88	10:52	0.12	-	52	404.29	61.88	
11/05/88	9:17	0.14	-	53	409.15	49.1	- system increased to 16.3 cfm per well
13/05/88	11:26	0.17	-	53	406.62	48.56	
16/05/88	14:55	0.25	-	53	405.13	59	
18/05/88	11:45	0.2	-	52	409.35	53.78	- system increased to 22 cfm per well - slow pressure response
18/05/88	17:25	0.22	-	-	409.03	57.38	
18/05/88	14:17	0.17	-	-	409.03	57.38	
20/05/88	12:03	0.18	-	52	407.42	59.72	- system shutdown and removed from site.
24/05/88	10:36	0.12	-	55	405.98	55.2	
25/05/88	10:16	0.12	-	52	408.83	46.9	
25/05/88	11:31	0	-	-	408.91	48.38	- system increased to 22 cfm per well - slow pressure response
25/05/88	12:09	-0.05	-	-	408.91	49.64	
25/05/88	13:42	0.03	-	53	408.67	53.42	
27/05/88	10:58	0	-	52	409.03	67.82	- system increased to 22 cfm per well - slow pressure response
30/05/88	17:00	-0.02	-	51	408.19	87.08	
01/06/88	16:59	0.03	-	53	404.65	77.72	
01/06/88	20:17	-0.1	-	-	405.94	59	- system shutdown and removed from site.
03/06/88	17:08	-0.16	-	53	407.9	61.88	
05/06/88	13:24	0.04	-	53	406.14	76.28	
08/06/88	16:55	-0.08	-	54	405.98	51.8	- system shutdown and removed from site.
16/06/88	-	-	40.5	-	-	-	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP 6 B-88		GROUND ELEV.: 205.0m AMSL		DEPTH OF SCREEN: 1.1 TO 2.3 (m BGS)		SCREENED ELEVATION: 203.9 TO 202.7 (m AMSL)	
PAGE 1						COMMENTS	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.3	-	57	408.83	28	- test burn
08/03/88	11:26	0.25	-	57	411.24	38.7	
07/04/88	16:00	-0.15	-	-	-	-	
09/05/88	10:27	0.5	-	-	404.97	64.22	- system started - 6 cfm per well
09/05/88	13:21	0.4	-	-	404.61	64.76	
09/05/88	13:32	0.25	-	-	404.61	64.76	
09/05/88	13:54	0.13	-	-	404.61	64.76	
09/05/88	15:03	-	-	58	404.09	67.64	
10/05/88	10:52	0.07	-	61	404.29	61.88	
11/05/88	9:17	0.05	-	60	409.15	49.1	- system increased to 10.5 cfm per well - system off for approximately 24 hours
13/05/88	11:26	0.08	-	60	406.62	48.56	
16/05/88	14:50	0.12	-	60	405.13	59	
18/05/88	11:45	0.08	-	58	409.35	53.78	- system increased to 16.3 cfm per well
18/05/88	13:25	0.1	-	-	409.03	57.38	
18/05/88	14:17	0.06	-	-	409.03	57.38	
20/05/88	12:03	0.07	-	59	407.42	59.72	
24/05/88	10:36	0.03	-	61	405.98	55.2	
25/05/88	10:16	0.03	-	58	408.83	46.9	
25/05/88	11:31	-0.06	-	-	408.91	48.38	- system increased to 22 cfm per well - slow pressure response
25/05/88	12:09	-0.12	-	-	408.91	49.64	
25/05/88	13:42	-0.05	-	58	408.67	53.42	
27/05/88	10:58	-0.08	-	40	409.03	67.82	
30/05/88	17:00	-0.07	-	36	408.19	87.08	
01/06/88	16:59	-0.07	-	40	404.65	77.72	
01/06/88	20:17	-0.2	-	-	405.94	59	- system shutdown and removed from site.
03/06/88	17:08	-0.03	-	14	407.9	61.88	
05/06/88	13:24	-0.03	-	2	406.14	76.28	
08/06/88	16:55	-0.16	-	0	405.98	51.8	
16/06/88	-	-	21	-	-	-	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP7A-88			GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 4.8 TO 6.0 (m BGS)		SCREENED ELEVATION: 201.0 TO 199.8 (m AMSL)		COMMENTS
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.					
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)					
04/03/88	14:00	0.35	-	50	408.83	28	- test burn				
08/03/88	11:28	0.25	-	52	411.24	52					
07/04/88	16:00	-0.3	-	-	-	-					
09/05/88	10:25	0.4	-	-	404.97	64.22	- system started - 6 cfm per well				
09/05/88	13:22	0.35	-	-	404.61	64.76					
09/05/88	13:33	0.13	-	-	404.61	64.76					
09/05/88	13:55	0.07	-	-	404.61	64.76					
09/05/88	15:00	-	-	53	404.09	67.64					
10/05/88	10:54	0.05	-	52	404.29	61.88					
11/05/88	9:19	0	-	51	409.15	49.1	- system increased to 10.5 cfm per well - system off for approximately 24 hours				
13/05/88	11:29	0	-	51	406.62	48.56					
16/05/88	14:53	0.09	-	50	405.13	59					
18/05/88	11:47	0.05	-	51	409.35	53.78	- system increased to 16.3 cfm per well				
18/05/88	13:26	0	-	-	409.03	57.38					
18/05/88	14:20	0	-	-	409.03	57.38					
20/05/88	12:05	0	-	50	407.42	59.72					
24/05/88	10:38	-0.06	-	56	405.98	55.2					
25/05/88	10:18	-0.04	-	54	408.83	46.9					
25/05/88	11:32	-0.15	-	-	408.91	48.38	- system increased to 22 cfm per well - slow pressure response				
25/05/88	12:11	-0.23	-	-	408.91	49.64					
25/05/88	13:46	-0.18	-	52	408.67	53.42					
27/05/88	11:01	-0.12	-	51	408.95	71.24					
30/05/88	17:02	-0.15	-	51	408.19	87.08					
01/06/88	17:02	-0.17	-	50	404.65	77.72					
01/06/88	20:19	-0.33	-	-	405.94	59	- system shutdown and removed from site.				
03/06/88	17:14	-0.25	-	51	407.9	61.88					
05/06/88	13:28	-0.12	-	51	406.14	76.28					
08/06/88	16:58	-0.26	-	51	405.98	51.8					
16/06/88	-	-	42	-	-	-					
20/06/88	-	-	-	-	-	-					

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP7B-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 1.3 TO 2.5 (m BGS)		SCREENED ELEVATION: 204.5 TO 203.3 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	14:00	0.3	-	57	408.83	28	- test burn		
01/01/04	11:30	0.25	-	59	411.24	38.7			
07/04/88	16:00	-0.25	-	-	-	-			
09/05/88	10:25	0.4	-	-	404.97	64.22	- system started - 6 cfm per well		
09/05/88	13:22	0.36	-	-	404.61	64.76			
09/05/88	13:33	0.15	-	-	404.61	64.76			
09/05/88	13:55	0.07	-	-	404.61	64.76	- system increased to 10.5 cfm per well - system off for approximately 24 hours		
09/05/88	15:00	-	-	60	404.09	67.64			
10/05/88	10:54	0.05	-	72	404.29	61.88			
11/05/88	9:19	0	-	74	409.15	49.1	- system increased to 16.3 cfm per well		
13/05/88	11:29	0	-	76	406.62	48.56			
16/05/88	14:53	0.12	-	66	405.13	59			
18/05/88	11:47	0.1	-	70	409.35	53.78	- system increased to 22 cfm per well - slow pressure response		
18/05/88	13:26	0.03	-	-	409.03	57.38			
18/05/88	14:20	0.03	-	-	409.03	57.38			
20/05/88	12:05	0	-	61	407.42	59.72	- system shutdown and removed from site.		
24/05/88	10:38	-0.03	-	72	405.98	55.2			
25/05/88	10:18	0.02	-	62	408.83	46.9			
25/05/88	11:32	-0.14	-	-	408.91	48.38	- system increased to 22 cfm per well - slow pressure response		
25/05/88	12:11	-0.18	-	-	408.91	49.64			
25/05/88	13:46	-0.12	-	63	408.67	53.42			
27/05/88	11:01	-0.13	-	21	408.95	71.24	- system increased to 22 cfm per well - slow pressure response		
30/05/88	17:02	-0.12	-	15	408.19	87.08			
01/06/88	17:02	-0.15	-	14	404.65	77.72			
01/06/88	20:19	-0.31	-	-	405.94	59	- system increased to 22 cfm per well - slow pressure response		
03/06/88	17:14	-0.23	-	35	407.9	61.88			
05/06/88	13:28	-0.12	-	0	406.14	76.28			
08/06/88	16:58	-0.23	-	0	405.98	51.8	- system shutdown and removed from site.		
16/06/88	-	-	25.5	-	-	-			
20/06/88	-	-	-	-	-	-			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 8 A-88		GROUND ELEV.: 208.0m AMSL		DEPTH OF SCREEN: 4.9 TO 6.1 (m BGS)		SCREENED ELEVATION: 203.1 TO 201.9 (m BGS)			
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS				
(D/M/Y)		(IN. H20)	(DEG. F)	(% VOL.)	(IN. H20)	(DEG. F)					
04/03/88	14:00	0.45	-	62	408.83	28					
08/03/88	8:35	0.45	-	65	412.04	30.7					
07/04/88	16:00	0.05	-	-	-	-					
09/05/88	10:48	0.55	-	-	404.97	64.22					
09/05/88	13:20	0.6	-	-	404.61	64.76	- test burn				
09/05/88	13:31	0.43	-	-	404.61	64.76					
09/05/88	13:54	0.33	-	-	404.61	64.76					
09/05/88	15:05	-	-	60	404.09	67.64					
10/05/88	10:50	0.2	-	60	404.29	61.88					
11/05/88	9:14	0.18	-	62	409.15	49.1					
13/05/88	11:31	0.17	-	62	406.62	48.56					
16/05/88	14:51	0.24	-	60	405.13	59					
18/05/88	11:43	0.24	-	60	409.35	53.78					
18/05/88	13:23	0.25	-	-	409.03	57.38	- system increased to 10.5 cfm per well				
18/05/88	14:14	0.21	-	-	409.03	57.38	- system off for approximately 24 hours				
20/05/88	12:02	0.23	-	60	407.42	59.72					
24/05/88	10:34	0.17	-	64	405.98	55.2					
25/05/88	10:14	0.13	-	61	408.83	46.9					
25/05/88	11:29	0.08	-	-	408.91	48.38	- system increased to 16.3 cfm per well				
25/05/88	12:08	0.03	-	-	408.91	49.64					
25/05/88	13:39	0.08	-	62	408.67	53.42					
27/05/88	10:55	0	-	61	409.03	67.82					
30/05/88	16:58	0.06	-	61	408.27	87.08					
01/06/88	16:56	0.05	-	62	404.65	77.72					
01/06/88	20:15	-0.08	-	-	405.94	59	- system increased to 22 cfm per well				
03/06/88	17:05	0.06	-	61	407.9	61.88					
05/06/88	13:21	0.1	-	60	406.14	76.28					
08/06/88	16:52	-0.05	-	60	405.98	51.8					
16/06/88	-	-	42	-	-	-					
20/06/88	-	-	-	-	-	-	- system shutdown and removed from site.				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP 8 B - 88		GROUND ELEV.: 208.0m AMSL		DEPTH OF SCREEN: 0.9 TO 2.1 (m BGS)		SCREENED ELEVATION: 207.1 TO 205.9 (m AMSL)	
PAGE 1							
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	14:00	0.33	-	60	408.83	28	- test burn
08/03/88	8:40	0.32	-	62	412.04	30.7	
07/04/88	16:00	-0.05	-	-	-	-	
09/05/88	10:48	0.45	-	-	404.97	64.22	- system started - 6 cfm per well
09/05/88	13:20	0.5	-	-	404.61	64.76	
09/05/88	13:31	0.32	-	-	404.61	64.76	
09/05/88	13:54	0.25	-	-	404.61	64.76	
09/05/88	15:05	-	-	63	404.09	67.64	
10/05/88	10:50	0.12	-	64	404.29	61.88	- system increased to 10.5 cfm per well - system off for approximately 24 hours
11/05/88	9:14	0.08	-	64	409.15	49.1	
13/05/88	11:31	0.08	-	65	406.62	48.56	
16/05/88	14:51	0.16	-	64	405.13	59	
18/05/88	11:43	0.16	-	64	409.35	53.78	
18/05/88	13:23	0.21	-	-	409.03	57.38	- system increased to 16.3 cfm per well
18/05/88	14:14	0.11	-	-	409.03	57.38	
20/05/88	12:02	0.13	-	62	407.42	59.72	
24/05/88	10:34	0.07	-	68	405.98	55.2	
25/05/88	10:14	0.05	-	63	408.83	46.9	
25/05/88	11:29	0	-	-	408.91	48.38	- system increased to 22 cfm per well
25/05/88	12:08	0	-	-	408.91	49.64	
25/05/88	13:39	0.03	-	62	408.67	53.42	
27/05/88	10:55	0.02	-	62	409.03	67.82	
30/05/88	16:58	0.02	-	61	408.27	87.08	
01/06/88	16:56	0	-	62	404.65	77.72	- system increased to 22 cfm per well
01/06/88	20:15	-0.17	-	-	405.94	59	
03/06/88	17:05	-0.04	-	58	407.9	61.88	
05/06/88	13:21	0.02	-	54	406.14	76.28	
08/06/88	16:52	-0.08	-	56	405.98	51.8	
16/06/88	-	-	23	-	-	-	- system shutdown and removed from site.
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP9A-88		GROUND ELEV.: 210.6m AMSL		DEPTH OF SCREEN: 4.9 TO 6.1 (m BGS)		SCREENED ELEVATION: 205.7 TO 204.5 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H20)	(DEG. F)	(% VOL.)	(IN. H20)	(DEG. F)			
04/03/88	14:00	0.4	-	61	408.83	28			
08/03/88	8:30	0.5	-	63	412.04	30.7			
07/04/88	16:00	0.15	-	-	-	-		- test burn	
09/05/88	10:50	0.5	-	-	404.97	64.22			
09/05/88	13:20	0.8	-	-	404.61	64.76			
09/05/88	13:29	0.65	-	-	404.61	64.76		- system started - 6 cfm per well	
09/05/88	13:53	0.5	-	-	404.61	64.76			
09/05/88	15:07	-	-	61	404.09	67.64			
10/05/88	10:47	0.37	-	60	404.29	61.88			
11/05/88	9:12	0.25	-	60	409.15	49.1			
13/05/88	11:33	0.27	-	63	406.62	48.56			
16/05/88	14:48	0.42	-	62	405.13	59			
18/05/88	11:42	0.35	-	62	409.35	53.78			
18/05/88	13:22	0.4	-	-	409.03	57.38		- system increased to 10.5 cfm per well	
18/05/88	14:12	0.32	-	-	409.03	57.38		- system off for approximately 24 hours	
20/05/88	12:01	0.33	-	60	407.42	59.72			
24/05/88	10:32	0.27	-	64	405.98	55.2			
25/05/88	10:12	0.22	-	62	408.83	46.9			
25/05/88	11:28	0.23	-	-	408.91	48.38		- system increased to 16.3 cfm per well	
25/05/88	12:07	0.14	-	-	408.91	49.64			
25/05/88	13:37	0.2	-	62	408.67	53.42			
27/05/88	10:52	0.25	-	62	409.03	67.82			
30/05/88	16:56	0.21	-	63	408.27	87.08			
01/06/88	16:53	0.17	-	63	404.65	77.72			
01/06/88	20:13	0.05	-	-	405.94	59		- system increased to 22 cfm per well	
03/06/88	17:02	0.13	-	63	407.9	61.88			
05/06/88	13:18	0.22	-	63	406.14	76.28			
08/06/88	16:49	0.05	-	66	405.98	51.8			
16/06/88	-	-	42	-	-	-			
20/06/88	-	-	-	-	-	-		- system shutdown and removed from site.	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP9B-88				GROUND ELEV.: 210.6m AMSL		DEPTH OF SCREEN: 0.9 TO 2.1 (m BGS)		SCREENED ELEVATION: 209.7 TO 208.5 (m AMSL)		COMMENTS
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.						
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)						
04/03/88	14:00	0.23	-	59	408.83	28					- test burn	
08/03/88	8:35	0.23	-	61	412.04	30.7						
07/04/88	16:00	-0.25	-	-	-	-						
09/05/88	10:50	0.7	-	-	404.97	64.22					- system started - 6 cfm per well	
09/05/88	13:20	0.58	-	-	404.61	64.76						
09/05/88	13:29	0.45	-	-	404.61	64.76						
09/05/88	13:53	0.23	-	-	404.61	64.76						
09/05/88	15:07	-	-	56	404.09	67.64						
10/05/88	10:47	0.14	-	58	404.29	61.88						
11/05/88	9:12	0.08	-	62	409.15	49.1					- system increased to 10.5 cfm per well - system off for approximately 24 hours	
13/05/88	11:33	0.06	-	61	406.62	48.56						
16/05/88	14:48	0.17	-	60	405.13	59						
18/05/88	11:42	0.12	-	62	409.35	53.78						
18/05/88	13:22	0.15	-	-	409.03	57.38						
18/05/88	14:12	0.1	-	-	409.03	57.38						
20/05/88	12:01	0.07	-	58	407.42	59.72					- system increased to 16.3 cfm per well	
24/05/88	10:32	0.07	-	64	405.98	55.2						
25/05/88	10:12	0.05	-	61	408.83	46.9						
25/05/88	11:28	0	-	-	408.91	48.38						
25/05/88	12:07	-0.07	-	-	408.91	49.64						
25/05/88	13:37	0	-	62	408.67	53.42						
27/05/88	10:52	0	-	56	409.03	67.82					- system increased to 22 cfm per well	
30/05/88	16:56	0	-	50	408.27	87.08						
01/06/88	16:53	-0.07	-	50	404.65	77.72						
01/06/88	20:13	-0.24	-	-	405.94	59						
03/06/88	17:02	-0.18	-	25	407.9	61.88						
05/06/88	13:18	0	-	0	406.14	76.28						
08/06/88	16:49	-0.22	-	0	405.98	51.8					- system shutdown and removed from site.	
16/06/88	-	-	23	-	-	-						
20/06/88	-	-	-	-	-	-						

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP1-82		GROUND ELEV.: 204.0m AMSL		DEPTH OF SCREEN: 4.9 TO 6.1 (m BGS)			
PAGE 1		SCREENED ELEVATION: 197.9 TO 199.1 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	15:00	0.38	- -	0	408.83	28.8	- system started - 6 cfm per well
08/03/88	10:45	0.25	- -	0	411.64	36.3	
09/05/88	10:40	0.25	- -	- -	404.97	64.22	
10/05/88	11:15	0.17	- -	0	404.29	61.88	
11/05/88	9:41	0.08	- -	0	409.15	49.1	- system increased to 10.5 cfm per well - system off for approximately 24 hours
13/05/88	11:52	0	- -	0	406.62	48.56	
16/05/88	15:25	0.32	- -	0	404.33	63.3	
18/05/88	12:06	0	- -	0	409.35	53.78	
18/05/88	13:43	0.25	- -	- -	409.03	57.38	- system increased to 16.3 cfm per well
20/05/88	12:24	0	- -	0	407.42	59.72	
24/05/88	11:00	0	- -	0	406.18	55.6	
25/05/88	10:37	0	- -	0	408.83	46.9	
27/05/88	11:29	0	- -	0	408.95	71.24	- system increased to 22 cfm per well
30/05/88	17:35	0	- -	0	408.19	87.08	
01/06/88	17:33	0	- -	0	404.77	75.92	
03/06/88	17:43	0.05	- -	0	407.9	61.88	
05/06/88	13:58	0.05	- -	0	406.14	76.28	- system shutdown and removed from site.
08/06/88	17:21	0	- -	0	406.06	51.8	
20/06/88	- -	- -	- -	- -	- -	- -	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 2 A-82			GROUND ELEV.: 203.3m AMSL		DEPTH OF SCREEN: 1.8 TO 3.0 (m BGS)		SCREENED ELEVATION: 201.5 TO 203.0 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS			
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)				
04/03/88	15:00	0.45	- -	0	408.83	28.8	- 8.5 meters deep			
08/03/88	10:47	0.2	- -	0	411.64	36.3				
09/05/88	10:42	0.4	- -	- -	404.97	64.22				
10/05/88	11:17	-0.23	- -	0	404.29	61.88	- system started - 6 cfm per well			
11/05/88	9:44	0.1	- -	0	409.15	49.1				
13/05/88	11:55	0.2	- -	0	406.62	48.56				
16/05/88	15:28	0.48	- -	0	404.33	63.3	- system increased to 10.5 cfm per well - system off for approximately 24 hours			
18/05/88	12:08	0.15	- -	0	409.35	53.78				
18/05/88	13:44	0	- -	- -	409.03	57.38				
20/05/88	12:26	0	- -	0	407.42	59.72	- system increased to 16.3 cfm per well			
24/05/88	11:02	0	- -	0	406.18	55.6				
25/05/88	10:40	0.04	- -	0	408.83	46.9				
27/05/88	11:31	0.08	- -	0	408.95	71.24	- system increased to 22 cfm per well			
30/05/88	17:38	0.1	- -	0	408.19	87.08				
01/06/88	17:35	0.05	- -	0	404.77	75.92				
03/06/88	17:46	0.05	- -	0	407.9	61.88	- system shutdown and removed from site.			
05/06/88	14:00	0.08	- -	0	405.9	79.34				
08/06/88	17:23	0.02	- -	0	406.06	51.8				
20/06/88	- -	- -	- -	- -	- -	- -				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 2 B - 82			GROUND ELEV.: 203.3m AMSL		DEPTH OF SCREEN: 6.4 TO 7.6 (m BGS)		SCREENED ELEVATION: 196.9 TO 195.7 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS.	ATMOS.	COMMENTS			
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	TEMP. (DEG. F)				
04/03/88	15:00	0.3	-	60	408.83	28.8	- 4.5 meters deep			
08/03/88	10:49	0.35	-	60	412.64	36.3				
09/05/88	10:42	0.2	-	-	404.97	64.22				
10/05/88	11:17	0.2	-	56	404.29	61.88	- system started - 6 cfm per well			
11/05/88	9:44	0.17	-	55	409.15	49.1				
13/05/88	11:55	0.12	-	57	406.62	48.56				
16/05/88	15:28	0.35	-	53	404.33	63.3	- system increased to 10.5 cfm per well - system off for approximately 24 hours			
18/05/88	12:08	0.27	-	55	409.35	53.78				
18/05/88	13:44	0.23	-	-	409.03	57.38				
20/05/88	12:27	0.23	-	56	407.42	59.72	- system increased to 16.3 cfm per well			
24/05/88	11:02	0.15	-	58	406.18	55.6				
25/05/88	10:40	0.18	-	54	408.83	46.9				
27/05/88	11:31	0.17	-	56	408.95	71.24	- system increased to 22 cfm per well			
30/05/88	17:38	0.14	-	55	408.19	87.08				
01/06/88	17:35	0.07	-	56	404.77	75.92				
03/06/88	17:46	0.05	-	55	407.9	61.88	- system shutdown and removed from site.			
05/06/88	14:00	0.12	-	54	405.9	79.34				
08/06/88	17:23	0.03	-	60	406.06	51.8				
20/06/88	-	-	-	-	-	-				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP3 A-82		GROUND ELEV.: 202.0m AMSL			DEPTH OF SCREEN: 1.8 TO 3.0 (m BGS) SCREENED ELEVATION: 200.2 TO 199.0 (m AMSL)		
PAGE 1		COMMENTS					
DATE	TIME	PRES. (IN. H20)	TEMP. (DEG. F)	METH. (% VOL.)	ATMOS. PRES. (IN. H20)	ATMOS. TEMP. (DEG. F)	
(D/M/Y)							
04/03/88	15:00	0.3	- -	68	408.83	28.8	-4.25 meters deep
08/03/88	10:51	0.35	- -	68	411.64	36.3	
09/05/88	10:44	0.3	- -	- -	404.97	64.22	
10/05/88	11:20	0.2	- -	64	404.29	61.88	- system started - 6 cfm per well
11/05/88	9:46	0.23	- -	64	409.15	49.1	
13/05/88	11:57	0.15	- -	63	406.62	48.56	
16/05/88	15:31	0.36	- -	61	404.33	63.3	- system increased to 10.5 cfm per well - system off for approximately 24 hours
18/05/88	12:10	0.25	- -	62	409.35	53.78	
18/05/88	13:45	0.26	- -	- -	409.03	57.38	
20/05/88	12:29	0.26	- -	63	407.42	59.72	- system increased to 16.3 cfm per well
24/05/88	11:04	0.24	- -	63	406.18	55.6	
25/05/88	10:42	0.19	- -	62	408.83	46.9	
27/05/88	11:33	0.2	- -	62	408.95	71.24	- system increased to 22 cfm per well
30/05/88	17:40	0.22	- -	62	408.19	87.08	
01/06/88	17:38	0.14	- -	62	404.77	75.92	
03/06/88	17:49	0.12	- -	61	407.9	61.88	- system shutdown and removed from site.
05/06/88	14:03	0.15	- -	60	405.9	79.34	
08/06/88	17:27	0.09	- -	63	406.06	51.8	
20/06/88	- -	- -	- -	- -	- -	- -	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP3B-82		GROUND ELEV.: 202.0m AMSL		DEPTH OF SCREEN: 6.4 TO 7.6 (m BGS)			
PAGE 1		SCREENED ELEVATION: 195.6 TO 194.4 (m AMSL)					
DATE	TIME	PRES. (IN. H2O)	TEMP. (DEG. F)	METH. (% VOL.)	ATMOS. PRES. (IN. H2O)	ATMOS. TEMP. (DEG. F)	COMMENTS
(D/M/Y)							
04/03/88	15:00	0.3	-	61	408.83	28.8	- 6.7 meters deep
08/03/88	10:53	0.35	-	60	411.64	36.3	
09/05/88	10:44	0.35	-	-	404.97	64.22	
10/05/88	11:20	0.23	-	59	404.29	61.88	- system started - 6 cfm per well
11/05/88	9:46	0.22	-	59	409.15	49.1	
13/05/88	11:57	0.15	-	58	406.62	48.56	
16/05/88	15:31	0.38	-	57	404.33	63.3	- system increased to 10.5 cfm per well - system off for approximately 24 hours
18/05/88	12:10	0.3	-	58	409.35	53.78	
18/05/88	13:45	0.26	-	-	409.03	57.38	
20/05/88	12:30	0.27	-	58	407.42	59.72	- system increased to 16.3 cfm per well
24/05/88	11:04	0.24	-	59	406.18	55.6	
25/05/88	10:42	0.23	-	60	408.83	46.9	
27/05/88	11:33	0.24	-	60	408.95	71.24	- system increased to 22 cfm per well
30/05/88	17:40	0.18	-	57	408.19	87.08	
01/06/88	17:38	0.14	-	58	404.77	75.92	
03/06/88	17:49	0.14	-	57	407.9	61.88	- system shutdown and removed from site.
05/06/88	14:03	0.17	-	54	405.9	79.34	
08/06/88	17:27	0.09	-	63	406.06	51.8	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 6A-82		GROUND ELEV.: 203.7m AMSL		DEPTH OF SCREEN: 1.8 TO 3.0 (m BGS)		SCREENED ELEVATION: 201.9 TO 200.7 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(% VOL.)		(IN. H2O)	(DEG. F)			
04/03/88	15:00	0.25	-	42	408.83	28.8	- system started - 6 cfm per well		
08/03/88	10:55	0.25	-	44	411.64	36.3			
09/05/88	10:46	0.25	-	-	404.97	64.22			
09/05/88	15:10	-	-	54	404.09	67.64	- system increased to 10.5 cfm per well - system off for approximately 24 hours		
10/05/88	11:23	0.1	-	56	404.29	61.88			
11/05/88	9:50	0.1	-	56	409.15	49.1			
13/05/88	12:00	0.1	-	50	406.62	48.56			
16/05/88	15:36	0.27	-	53	404.33	63.3			
18/05/88	12:14	0.18	-	56	409.35	53.78	- system increased to 16.3 cfm per well		
18/05/88	13:48	0.18	-	-	409.03	57.38			
20/05/88	12:33	0.17	-	56	407.42	59.72			
24/05/88	11:10	0.1	-	54	406.18	55.6	- system increased to 22 cfm per well		
25/05/88	10:46	0.08	-	59	408.83	46.9			
25/05/88	12:24	0.05	-	-	408.91	49.64			
25/05/88	14:00	0.13	-	57	408.67	53.42	- system shutdown and removed from site.		
27/05/88	11:38	0.09	-	59	408.94	71.24			
30/05/88	17:47	0.08	-	54	408.19	87.08			
01/06/88	17:44	0.05	-	58	404.77	75.92			
01/06/88	20:32	0	-	-	405.94	59			
03/06/88	17:53	0.03	-	54	407.9	61.88			
05/06/88	14:08	0.1	-	55	405.9	79.34			
08/06/88	17:31	0.03	-	59	406.06	51.8			
20/06/88	-	-	-	-	-	-			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP 6B-82		GROUND ELEV.: 203.7 AMSL			DEPTH OF SCREEN: 6.4 TO 7.6 (m BGS)		SCREENED ELEVATION: 197.3 TO 196.1 (m AMSL)	
PAGE 1								
DATE	TIME	PRES. (IN. H2O)	TEMP. (DEG. F)	METH. (% VOL.)	ATMOS. PRES. (IN. H2O)	ATMOS. TEMP. (DEG. F)	COMMENTS	
(D/M/Y)								
04/03/88	14:00	0.75	- -	0	408.83	28.8	- 6.5 meters deep	
08/03/88	10:59	0.2	- -	0	411.64	36.3		
09/05/88	10:46	0.35	- -	- -	404.97	64.22		
09/05/88	15:10	- -	- -	0	404.09	67.64	- system started - 6 cfm per well	
10/05/88	11:23	0	- -	0	404.29	61.88		
11/05/88	9:50	0	- -	- -	409.15	49.1		
13/05/88	12:00	0	- -	0	406.62	48.56	- system increased to 10.5 cfm per well - system off for approximately 24 hours	
16/05/88	15:36	0.3	- -	0	404.33	63.3		
18/05/88	12:14	0.32	- -	0	409.35	53.78		
18/05/88	13:48	0	- -	- -	409.03	57.38	- system increased to 16.3 cfm per well	
20/05/88	12:34	0	- -	0	407.42	59.72		
24/05/88	11:10	0.05	- -	0	406.18	55.6		
25/05/88	10:46	0.02	- -	0	408.83	46.9	- system increased to 22 cfm per well	
25/05/88	12:24	0.1	- -	- -	408.91	49.64		
25/05/88	14:00	0.1	- -	0	408.67	53.42		
27/05/88	11:38	0	- -	0	408.94	71.24	- system shutdown and removed from site.	
30/05/88	17:47	0	- -	0	408.19	87.08		
01/06/88	17:44	0.08	- -	0	404.77	75.92		
01/06/88	20:32	0.05	- -	- -	405.94	59	- system shutdown and removed from site.	
03/06/88	17:53	0.07	- -	0	407.9	61.88		
05/06/88	14:08	0.05	- -	0	405.9	79.34		
08/06/88	17:31	0	- -	0	406.06	51.8		
20/06/88	- -	- -	- -	- -	- -	- -		

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 7-82			GROUND ELEV.: 211.0m AMSL		DEPTH OF SCREEN: 1.8 TO 3.0 (m BGS)		SCREENED ELEVATION: 209.2 TO 208.0 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS			
(D/M/Y)		(IN. H20)	(DEG. F)	(% VOL.)	(IN. H20)	(DEG. F)				
04/03/88	15:45	0.5	-	48	408.83	28.8	- system started - 6 cfm per well			
08/03/88	11:05	0.55	-	57	411.24	38.7				
09/05/88	10:39	0.6	-	-	404.97	64.22				
10/05/88	11:13	0.48	-	54	404.29	61.88	- system increased to 10.5 cfm per well - system off for approximately 24 hours			
11/05/88	9:38	0.37	-	54	409.15	49.1				
13/05/88	11:50	0.37	-	55	406.62	48.56				
16/05/88	15:20	0.67	-	52	404.33	63.3	- system increased to 16.3 cfm per well			
18/05/88	12:04	0.5	-	53	409.35	53.78				
18/05/88	13:41	0.5	-	-	409.03	57.38				
20/05/88	12:20	0.5	-	54	407.42	59.72	- system increased to 22 cfm per well			
24/05/88	10:57	0.42	-	54	406.18	55.6				
25/05/88	10:35	0.41	-	55	408.83	46.9				
27/05/88	11:26	0.43	-	56	408.94	71.24	- system shutdown and removed from site.			
30/05/88	17:30	0.36	-	53	408.19	87.08				
01/06/88	17:30	0.34	-	54	404.77	75.92				
03/06/88	17:40	0.29	-	52	407.9	61.88				
05/06/88	13:55	0.27	-	52	406.14	76.28				
08/06/88	17:22	0.22	-	55	406.06	51.8				
20/06/88	-	-	-	-	-	-				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

APPENDIX C

UTILIZATION SYSTEM

MONITORING RESULTS

PAGE 1		GP10A-88		GROUND ELEV.: 205.0m AMSL		DEPTH OF SCREEN: 8.8 TO 10.0 (m BGS)		SCREENED ELEVATION: 196.2 TO 195.0 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H20) (DEG. F)	(% VOL.)		(IN. H20)	(DEG. F)			
04/03/88	16:00	0	- -	0	408.83	30			
08/03/88	10:30	0.4	65	0	411.64	36.3			
09/05/88	9:55	0.2	- -	- -	405.01	65.66			
09/05/88	14:15	- -	- -	0	404.45	64.76	- system start-up - 50 cfm		
10/05/88	9:26	0.38	- -	0	404.09	61.88			
11/05/88	10:15	0	- -	0	409.27	52.88			
13/05/88	9:10	0.05	- -	0	404.65	66.38			
16/05/88	13:00	0	- -	0	404.21	60.8	- system decreased to 40 cfm - system increased to 50 cfm		
18/05/88	10:25	0.05	- -	0	409.39	50			
20/05/88	12:50	0.4	- -	0	407.38	62.78			
24/05/88	11:25	0	- -	0	406.18	55.58			
25/05/88	12:32	0.08	- -	- -	408.91	49.64	- system decreased to 40 cfm - system increased to 60 cfm		
25/05/88	14:06	0.02	- -	0	408.67	53.42			
27/05/88	11:35	0	- -	0	408.95	71.24	- system decreased to 36 cfm		
27/05/88	13:40	0.4	- -	- -	408.71	75.02			
27/05/88	14:00	-0.12	- -	- -	408.59	77.9			
30/05/88	17:57	0.06	- -	0	408.19	87.08			
01/06/88	17:54	0.05	- -	0	404.77	75.92			
03/06/88	18:00	0.05	- -	0	407.99	71.7			
05/06/88	14:18	0.19	- -	0	405.9	79.34			
08/06/88	17:53	0.03	- -	0	406.06	51.8	- system shutdown and removed from site.		
20/06/88	- -	- -	- -	- -	- -	- -			

NOTES: * - GENERAL NOTES FOR PROBE, - - - NOT MEASURED

PAGE 1		GP10B-88			GROUND ELEV.: 205.0m AMSL		DEPTH OF SCREEN: 6.3 TO 7.5 (m BGS)		SCREENED ELEVATION: 198.7 TO 197.5 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS			
(D/M/Y)		(IN. H2O) (DEG. F)	(% VOL.)		(IN. H2O)	(DEG. F)				
04/03/88	16:00	0.17	- -	55	408.83	30				
08/03/88	10:35	0.25	98	56	411.64	36.3				
09/05/88	9:55	0.25	- -	- -	405.01	65.66				
09/05/88	14:15	- -	- -	54	404.45	64.76	- system start-up - 50 cfm			
10/05/88	9:26	0.1	- -	54	404.09	61.88				
11/05/88	10:15	0.1	- -	53	409.27	52.88				
13/05/88	9:10	0.18	- -	54	404.65	66.38				
16/05/88	13:00	0.12	- -	53	404.21	60.8	- system decreased to 40 cfm - system increased to 50 cfm			
18/05/88	10:25	0.08	- -	53	409.39	50				
20/05/88	12:50	0.08	- -	52	407.38	62.78				
24/05/88	11:25	0.09	- -	53	406.18	55.58				
25/05/88	12:32	0.08	- -	- -	408.91	49.64	- system decreased to 40 cfm - system increased to 60 cfm			
25/05/88	14:06	0.05	- -	55	408.67	53.42				
27/05/88	11:35	0.03	- -	54	408.95	71.24				
27/05/88	13:40	0.12	- -	- -	408.71	75.02	- system decreased to 36 cfm			
27/05/88	14:00	0.14	- -	- -	408.59	77.9				
30/05/88	17:57	0.12	- -	54	408.19	87.08				
01/06/88	17:54	0.11	- -	52	404.77	75.92				
03/06/88	18:00	0.1	- -	52	407.99	71.7				
05/06/88	14:18	0.13	- -	51	405.9	79.34				
08/06/88	17:53	0.1	- -	55	406.06	51.8	- system shutdown and removed from site.			
20/06/88	- -	- -	- -	- -	- -	- -				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP10C-88		GROUND ELEV.: 205.0m AMSL		DEPTH OF SCREEN: 1.6 TO 2.8 (m BGS)		SCREENED ELEVATION: 203.4 TO 202.2 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.05	- -	56	408.83	30			
08/03/88	10:45	0.05	109	58	411.64	36.3			
09/05/88	10:00	0.05	- -	- -	405.01	65.66			
09/05/88	14:15	- -	- -	59	404.45	64.76	- system start-up - 50 cfm		
10/05/88	9:32	0.05	- -	60	404.09	61.88			
11/05/88	10:20	0.05	- -	56	409.27	52.88			
13/05/88	9:15	0.05	- -	58	404.65	66.38			
16/05/88	13:12	0	- -	57	404.21	60.8	- system decreased to 40 cfm		
18/05/88	10:30	0	- -	57	409.47	50.72	- system increased to 50 cfm		
20/05/88	12:50	0	- -	56	407.38	62.78			
24/05/88	11:25	0.02	- -	58	406.18	55.58	- system decreased to 40 cfm		
25/05/88	12:32	0.04	- -	- -	408.91	49.64			
25/05/88	14:06	0.02	- -	58	408.67	53.42	- system increased to 60 cfm		
27/05/88	11:35	0	- -	0	408.95	71.24	- system decreased to 36 cfm		
27/05/88	13:40	0.03	- -	- -	408.71	75.02			
27/05/88	14:00	0.03	- -	- -	408.59	77.9			
30/05/88	17:57	0.03	- -	58	408.19	87.08			
01/06/88	17:54	0.03	- -	58	404.77	75.92			
03/06/88	18:00	0.02	- -	57	407.99	71.7			
05/06/88	14:18	0.05	- -	56	405.9	79.34			
08/06/88	17:53	0.03	- -	58	406.06	51.8	- system shutdown and removed from site.		
20/06/88	- -	- -	- -	- -	- -	- -			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP11A-88		GROUND ELEV.: 205.3m AMSL		DEPTH OF SCREEN: 20.3 TO 21.5 (m BGS)		SCREENED ELEVATION: 185.0 TO 183.8 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.85	-	2	408.83	30	- black tar in probe		
08/03/88	10:05	0.3	-	1	411.64	36.3			
09/05/88	10:00	3.5	-	-	405.01	65.66			
09/05/88	14:20	-	-	44	404.45	64.76	- system start-up - 50cfm		
10/05/88	9:32	0.95	-	54	404.09	61.88			
11/05/88	10:21	10	-	50	409.27	52.88	- drops off		
13/05/88	9:16	50	-	68	404.65	66.38	- blows cap off probe		
16/05/88	13:15	>50	-	67	404.21	60.8	- system decreased to 40cfm		
18/05/88	10:30	0	-	12	409.47	50.72	- system increased to 50cfm		
20/05/88	12:53	0.2	-	47	407.38	62.78			
24/05/88	11:30	0	-	38	406.18	55.58			
25/05/88	12:34	0	-	-	408.91	49.64	- system decreased to 40cfm		
25/05/88	14:11	0.02	-	0	408.67	53.42	- system increased to 60cfm		
27/05/88	11:40	0.05	-	19	408.95	71.24			
27/05/88	13:43	0.31	-	-	408.71	75.02	- system decreased to 36cfm		
27/05/88	14:00	0.03	-	-	408.59	77.9			
30/05/88	18:02	0.02	-	31	408.11	85.64			
01/06/88	17:59	0	-	20	404.77	75.92			
03/06/88	18:04	0.02	-	26	407.99	71.7	- bulb does not expand		
05/06/88	14:22	0.13	-	51	405.9	79.34			
08/06/88	17:58	0.05	-	32	406.06	51.8	- system shutdown and removed from site.		
20/06/88	-	-	-	-	-	-			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 11 B-88		GROUND ELEV.: 205.3m AMSL		DEPTH OF SCREEN: 17.1 TO 18.3 (m BGS)		SCREENED ELEVATION: 188.2 TO 187.0 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	16:00	0	- -	0	408.83	30	- black tar in probe		
08/03/88	10:10	0.25	105	2	411.64	36.3			
09/05/88	10:00	0	- -	- -	405.01	65.66			
09/05/88	14:20	- -	- -	0	404.45	64.76	- system start-up - 50 cfm		
10/05/88	9:32	-0.25	- -	0	404.09	61.88			
11/05/88	10:21	0.33	- -	0	409.27	52.88			
13/05/88	9:16	0	- -	0	404.65	66.38	- system decreased to 40 cfm - system increased to 50 cfm		
16/05/88	13:15	0	- -	0	404.21	60.8			
18/05/88	10:30	0	- -	0	409.47	50.72			
20/05/88	12:53	0	- -	11	407.38	62.78	- system decreased to 40 cfm - system increased to 60 cfm		
24/05/88	11:30	0	- -	6	406.18	55.58			
25/05/88	12:34	0.03	- -	- -	408.91	49.64			
25/05/88	14:11	0.03	- -	8	408.67	53.42	- system decreased to 36 cfm		
27/05/88	11:40	0.03	- -	0	408.95	71.24			
27/05/88	13:43	0.23	- -	- -	408.71	75.02			
27/05/88	14:03	0.15	- -	- -	408.59	77.9	- bulb does not expand		
30/05/88	18:02	0.07	- -	13	408.11	85.64			
01/06/88	17:59	0.05	- -	55	404.77	75.92			
03/06/88	18:04	0.12	- -	19	407.99	71.7	- system shutdown and removed from site.		
05/06/88	14:22	0.07	- -	0	405.9	79.34			
08/06/88	17:58	0.07	- -	28	406.06	51.8			
20/06/88	- -	- -	- -	- -	- -	- -			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP11C-88		GROUND ELEV.: 205.3m AMSL		DEPTH OF SCREEN: 9.8 TO 11.1 (m BGS)		SCREENED ELEVATION: 195.5 TO 194.2 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(% VOL.)		(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.6	- -	0	408.83	30			
08/03/88	10:15	0.05	108	0	411.64	36.3			
09/05/88	10:00	0.3	- -	- -	405.01	65.66			
09/05/88	14:20	- -	- -	0	404.45	64.76			
10/05/88	9:32	0.6	- -	54	404.09	61.88			
11/05/88	10:21	0.23	- -	56	409.27	52.88			
13/05/88	9:16	0.2	- -	2	404.65	66.38			
16/05/88	13:15	-0.05	- -	6	404.21	60.8			
18/05/88	10:30	0	- -	60	409.47	50.72			
20/05/88	12:53	0	- -	60	407.38	62.78			
24/05/88	11:30	-0.02	- -	40	406.18	55.58			
25/05/88	12:34	0.03	- -	- -	408.91	49.64			
25/05/88	14:11	0.03	- -	60	408.67	53.42			
27/05/88	11:40	0.03	- -	56	408.95	71.24			
27/05/88	13:43	0.1	- -	- -	408.71	75.02			
27/05/88	14:03	0.1	- -	- -	408.59	77.9			
30/05/88	18:02	0.12	- -	60	408.11	85.64			
01/06/88	17:59	0.08	- -	45	404.77	75.92			
03/06/88	18:04	0.06	- -	60	407.99	71.7			
05/06/88	14:22	0.09	- -	12	405.9	79.34			
08/06/88	17:58	0.03	- -	60	406.06	51.8			
20/06/88	- -	- -	- -	- -	- -	- -			
							- system start-up - 50cfm		
							- system decreased to 40 cfm		
							- system increased to 50 cfm		
							- system decreased to 40 cfm		
							- system increased to 60 cfm (SLOW)		
							- system decreased to 36 cfm		
							- system shutdown and removed from site.		

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP11D-88		GROUND ELEV.: 205.3m AMSL		DEPTH OF SCREEN: 1.4 TO 2.6 (m BGS)		SCREENED ELEVATION: 203.9 TO 202.7 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.05	- -	62	408.83	30	- system start-up - 50cfm		
08/03/88	11:20	0.05	40	60	411.64	36.3			
09/05/88	10:00	0.05	- -	- -	405.01	65.66			
09/05/88	14:20	- -	- -	74	404.45	64.76			
10/05/88	9:32	0.05	- -	74	404.09	61.88	- system decreased to 40 cfm - system increased to 50 cfm		
11/05/88	10:21	0	- -	74	409.27	52.88			
13/05/88	9:16	0.05	- -	72	404.65	66.38			
16/05/88	13:15	0	- -	72	404.21	60.8			
18/05/88	10:30	0.05	- -	72	409.47	50.72	- system decreased to 40 cfm - system increased to 60 cfm - pressure fluctuates between 0 and +0.15 - system decreased to 36 cfm		
20/05/88	12:53	0.03	- -	70	407.38	62.78			
24/05/88	11:30	0	- -	74	406.18	55.58			
25/05/88	12:34	0.02	- -	- -	408.91	49.64			
25/05/88	14:11	0.04	- -	75	408.67	53.42	- system shutdown and removed from site.		
27/05/88	11:40	0.075	- -	74	408.95	71.24			
27/05/88	13:43	0.02	- -	- -	408.71	75.02			
27/05/88	14:03	0	- -	- -	408.59	77.9			
30/05/88	18:02	0.03	- -	72	408.11	85.64			
01/06/88	17:59	0.02	- -	70	404.77	75.92			
03/06/88	18:04	0	- -	62	407.99	71.7			
05/06/88	14:22	0.02	- -	51	405.9	79.34			
08/06/88	17:58	0	- -	44	406.06	51.8			
20/06/88	- -	- -	- -	- -	- -	- -			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP11E-88		GROUND ELEV.: 205.3m AMSL		DEPTH OF SCREEN: 8.1 TO 8.4 (m BGS)		SCREENED ELEVATION: 197.2 TO 196.9 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.1	-	0	408.83	30			
08/03/88	11:25	1.6	95	0	411.64	36.3			
09/05/88	10:00	3.4	-	-	405.01	65.66			
09/05/88	14:22	-	-	48	404.45	64.76		- system start-up - 50cfm	
10/05/88	9:32	0.1	-	2	404.09	61.88			
11/05/88	10:21	0.4	-	0	409.27	52.88			
13/05/88	9:16	0.08	-	2	404.65	66.38			
16/05/88	13:15	0	-	51	404.21	60.8		- system decreased to 40 cfm	
18/05/88	10:30	2	-	59	409.47	50.72		- system increased to 50 cfm	
20/05/88	12:53	0.25	-	47	407.38	62.78			
24/05/88	11:30	0.64	-	58	406.18	55.58			
25/05/88	12:34	0.08	-	-	408.91	49.64		- system decreased to 40 cfm	
25/05/88	14:11	0.08	-	51	408.67	53.42		- system increased to 60 cfm	
27/05/88	11:40	1.1	-	54	408.95	71.24			
27/05/88	13:43	>1	-	-	408.71	75.02		- system decreased to 36 cfm	
27/05/88	14:03	>1	-	-	408.59	77.9			
30/05/88	18:02	0.13	-	52	408.11	85.64			
01/06/88	17:59	0.13	-	51	404.77	75.92			
03/06/88	18:04	0.24	-	42	407.99	71.7		- fluctuates	
05/06/88	14:22	>1	-	46	405.9	79.34			
08/06/88	17:58	0.52	-	56	406.06	51.8		- system shutdown and removed from site.	
20/06/88	-	-	-	-	-	-			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP 11F-88			GROUND ELEV.: 205.3m AMSL		DEPTH OF SCREEN: 5.8 TO 6.1 (m BGS)		SCREENED ELEVATION: 199.5 TO 199.2 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS			
(D/M/Y)		(IN. H20)	(DEG. F)	(% VOL.)	(IN. H20)	(DEG. F)				
04/03/88	16:00	1.2	-	22	408.83	30	- meth. drops off over time, start at 42%, build pres - methane drops off over time			
08/03/88	10:30	0.8	86	18	411.64	36.3				
09/05/88	10:05	1	-	-	405.01	65.66	- system start-up - 50cfm			
09/05/88	14:22	-	-	54	404.45	64.76				
10/05/88	9:32	0.75	-	45	404.09	61.88	- system decreased to 40 cfm - system increased to 50 cfm			
11/05/88	10:30	0.4	-	52	409.27	52.88				
13/05/88	9:30	0.26	-	50	404.65	66.38	- system decreased to 40 cfm - system increased to 60 cfm			
16/05/88	13:25	0.1	-	52	404.21	60.8				
18/05/88	10:40	0.25	-	52	409.47	50.72	- system decreased to 40 cfm - system increased to 36 cfm			
20/05/88	12:53	0.07	-	44	407.38	62.78				
24/05/88	11:30	0.34	-	54	406.18	55.58	- system shutdown and removed from site.			
25/05/88	12:34	0.35	-	-	408.91	49.64				
25/05/88	14:11	0.05	-	54	408.67	53.42				
27/05/88	11:40	0.23	-	51	408.95	71.24				
27/05/88	13:43	0.27	-	-	408.71	75.02				
27/05/88	14:03	0.3	-	-	408.59	77.9				
30/05/88	18:02	0.34	-	53	408.11	85.64				
01/06/88	17:59	0.5	-	52	404.77	75.92				
03/06/88	18:04	0.26	-	52	407.99	71.7				
05/06/88	14:22	0.27	-	49	405.9	79.34				
08/06/88	17:58	8:38	-	53	406.06	51.8				
20/06/88	-	-	-	-	-	-				

NOTES: *. GENERAL NOTES FOR PROBE NOT MEASURED

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP12A-88		GROUND ELEV.: 205.5m AMSL			DEPTH OF SCREEN: 9.4 TO 10.7 (m BGS)		
PAGE 1		SCREENED ELEVATION: 196.1 TO 194.8 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	16:00	0.1	- -	52	408.83	30	- system start-up - 50cfm
08/03/88	9:40	0.1	102	54	412.04	32.7	
04/07/88	3:30	1.3	- -	- -			
04/07/88	3:40	1.6	- -	- -			
09/05/88	10:05	0.35	- -	- -	405.01	65.66	- SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading - system decreased to 40 cfm - system increased to 50 cfm - SLOW - SLOW - system decreased to 40 cfm - system increased to 60 cfm : SLOW - SLOW - system decreased to 36 cfm
09/05/88	11:08	-0.4	- -	- -	404.97	64.22	
09/05/88	11:16	-0.5	- -	- -	404.97	64.22	
09/05/88	11:20	-0.5	- -	- -	404.97	64.22	
09/05/88	11:41	-0.45	- -	- -	404.97	64.22	
09/05/88	13:00	-0.4	- -	- -	404.61	64.76	
09/05/88	14:25	- -	- -	49	404.45	64.76	
10/05/88	9:46	-0.43	- -	51	404.09	61.88	
11/05/88	10:32	-0.2	- -	47	409.27	52.88	
13/05/88	9:35	-0.26	- -	41	404.65	66.38	
16/05/88	13:30	-0.2	- -	49	405.13	59	
18/05/88	10:43	-0.33	- -	52	409.47	50.72	
20/05/88	13:02	-0.37	- -	46	407.38	62.78	
24/05/88	11:44	-0.15	- -	50	406.18	55.58	
25/05/88	12:38	-0.65	- -	- -	408.91	49.64	
25/05/88	14:19	-0.75	- -	44	408.67	53.42	
27/05/88	11:47	-0.63	- -	49	408.95	71.24	
27/05/88	13:47	-0.18	- -	- -	408.71	75.02	
27/05/88	14:07	-0.15	- -	- -	408.59	77.9	
30/05/88	18:09	-0.12	- -	52	408.11	85.64	
01/06/88	18:06	-0.15	- -	50	405.17	70.34	
03/06/88	18:10	-0.2	- -	50	407.99	71.7	
05/06/88	14:30	0.05	- -	48	405.9	79.34	
08/06/88	18:10	-0.14	- -	52	406.06	51.8	
16/06/88	- -	- -	- -	41.8	- -	- -	- clear water (approximately 4")
20/06/88	- -	- -	- -	- -	- -	- -	- system shutdown and removed from site.

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP12B-88		GROUND ELEV.: 205.5m AMSL			DEPTH OF SCREEN: 6.4 TO 7.7 (m BGS)		
PAGE 1		SCREENED ELEVATION: 199.1 TO 197.8 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	16:00	0.1	-	54	408.83	30	
08/03/88	9:50	0.08	91	57	412.04	32.7	
07/04/88	3:30	1	-	-			
07/04/88	3:40	1	-	-			
09/05/88	10:05	0.15	-	-	405.01	65.66	
09/05/88	11:08	-0.55	-	-	404.97	64.22	- system start-up - 50cfm
09/05/88	11:16	-0.65	-	-	404.97	64.22	
09/05/88	11:20	-0.65	-	-	404.97	64.22	
09/05/88	11:41	-0.6	-	-	404.97	64.22	
09/05/88	13:00	-0.65	-	-	404.61	64.76	
09/05/88	14:25	-	-	54	404.45	64.76	
10/05/88	9:46	-0.63	-	55	404.09	61.88	- SLOW : takes a long time to get a reading
11/05/88	10:32	-0.43	-	54	409.27	52.88	- SLOW : takes a long time to get a reading
13/05/88	9:35	-0.28	-	49	404.65	66.38	- SLOW : takes a long time to get a reading
16/05/88	13:30	-0.47	-	52	405.13	59	- system decreased to 40 cfm
18/05/88	10:43	-0.48	-	55	409.47	50.72	- system increased to 50 cfm
20/05/88	13:02	-0.57	-	51	407.38	62.78	- SLOW
24/05/88	11:44	-0.45	-	53	406.18	55.58	- SLOW
25/05/88	12:38	-0.83	-	-	408.91	49.64	- system decreased to 40 cfm
25/05/88	14:19	-0.83	-	56	408.67	53.42	- system increased to 60 cfm : SLOW
27/05/88	11:47	-0.87	-	52	408.95	71.24	- SLOW
27/05/88	13:47	-0.48	-	-	408.71	75.02	- system decreased to 36 cfm
27/05/88	14:07	-0.43	-	-	408.59	77.9	
30/05/88	18:09	-0.35	-	53	408.11	85.64	
01/06/88	18:06	-0.5	-	52	405.17	70.34	- SLOW
03/06/88	18:10	-0.53	-	43	407.99	71.7	- SLOW
05/06/88	14:30	-0.35	-	50	405.9	79.34	
08/06/88	18:10	-0.53	-	53	406.06	51.8	
16/06/88	-	-	-	37.6	-	-	- dry
20/06/88	-	-	-	-	-	-	- system shutdown and removed from site.

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP12C-88		GROUND ELEV.: 205.5m AMSL		DEPTH OF SCREEN: 3.7 TO 4.9 (m BGS)		SCREENED ELEVATION: 201.8 TO 200.6 (m AMSL)		COMMENTS
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.				
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)				
04/03/88	16:00	0.05	-	54	408.83	30				
08/03/88	10:00	0.05	77	58	412.04	32.7				
07/04/88	3:30	1	-	-						
07/04/88	3:40	0.8	-	-						
09/05/88	10:08	0.1	-	-	405.01	65.66				
09/05/88	11:08	-0.3	-	-	404.97	64.22	- system start-up - 50cfm			
09/05/88	11:16	-0.4	-	-	404.97	64.22				
09/05/88	11:20	-0.4	-	-	404.97	64.22				
09/05/88	11:41	-0.35	-	-	404.97	64.22				
09/05/88	13:00	-0.35	-	-	404.61	64.76				
09/05/88	14:31	-	-	56	404.45	64.76				
10/05/88	9:53	-0.32	-	60	404.09	61.88	- SLOW : takes a long time to get a reading			
11/05/88	10:30	-5:31	-	54	409.27	52.88	- SLOW : takes a long time to get a reading			
13/05/88	9:45	-0.28	-	53	404.65	66.38	- SLOW : takes a long time to get a reading			
16/05/88	13:40	-0.25	-	51	405.13	59	- system decreased to 40 cfm			
18/05/88	10:51	-0.3	-	62	409.47	50.72	- system increased to 50 cfm			
20/05/88	13:02	-0.32	-	56	407.38	62.78	- SLOW			
24/05/88	11:44	-0.25	-	60	406.18	55.58	- SLOW			
25/05/88	12:38	-0.45	-	-	408.91	49.64	- system decreased to 40 cfm			
25/05/88	14:19	-0.45	-	61	408.67	53.42	- system increased to 60 cfm : SLOW			
27/05/88	11:47	-0.42	-	59	408.95	71.24	- SLOW			
27/05/88	13:47	-0.25	-	-	408.71	75.02	- system decreased to 36 cfm			
27/05/88	14:07	-0.25	-	-	408.59	77.9				
30/05/88	18:09	-0.25	-	60	408.11	85.64				
01/06/88	18:06	-0.25	-	59	405.17	70.34	- SLOW			
03/06/88	18:10	-0.25	-	50	407.99	71.7	- SLOW			
05/06/88	14:30	-0.1	-	58	405.9	79.34				
08/06/88	18:10	-0.23	-	61	406.06	51.8				
16/06/88	-	-	-	23	-	-	- dry			
20/06/88	-	-	-	-	-	-	- system shutdown and removed from site.			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP13A-88		GROUND ELEV.: 205.6m AMSL		DEPTH OF SCREEN: 8.9 TO 10.1 (m BGS)		SCREENED ELEVATION: 196.7 TO 195.5 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(% VOL.)		(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.12	- -	54	408.83	30			
08/03/88	9:25	0.1	99	56	412.04	32.7			
07/04/88	3:30	1.2	- -	- -					
09/05/88	10:08	0.15	- -	- -	405.01	65.66			
09/05/88	11:10	-0.4	- -	- -	404.97	64.22		- system start-up - 50cfm	
09/05/88	11:17	-0.45	- -	- -	404.97	64.22			
09/05/88	11:21	-0.5	- -	- -	404.97	64.22			
09/05/88	11:42	-0.45	- -	- -	404.97	64.22			
09/05/88	13:02	-0.45	- -	- -	404.61	64.76			
09/05/88	14:32	- -	- -	47	404.45	64.76		- SLOW : takes a long time to get a reading	
10/05/88	9:57	-0.05	- -	48	404.09	61.88		- SLOW : takes a long time to get a reading	
11/05/88	10:33	-0.28	- -	45	409.27	52.88		- SLOW : takes a long time to get a reading	
13/05/88	11:05	-0.05	- -	44	406.62	48.56			
16/05/88	13:42	-0.34	- -	43	405.13	59		- system decreased to 40 cfm	
18/05/88	10:52	-0.37	- -	41	409.47	50.72		- system increased to 50 cfm	
20/05/88	13:10	-0.44	- -	44	407.38	62.78		- SLOW	
24/05/88	11:51	-0.37	- -	47	406.18	55.58		- SLOW	
25/05/88	12:40	-0.75	- -	- -	408.91	49.64		- system decreased to 40 cfm	
25/05/88	14:31	-0.73	- -	51	408.67	53.42		- system increased to 60 cfm : SLOW	
27/05/88	12:00	-0.62	- -	31	408.79	74.48		- SLOW	
27/05/88	13:50	-0.33	- -	- -	408.71	75.02		- system decreased to 36 cfm	
27/05/88	14:10	-0.33	- -	- -	408.59	77.9			
30/05/88	18:14	-0.32	- -	48	408.11	85.64		- SLOW	
01/06/88	18:13	-0.4	- -	45	405.17	70.34		- SLOW	
03/06/88	18:16	-0.35	- -	40	407.99	71.7		- SLOW	
05/06/88	14:40	-0.22	- -	40	405.9	79.34			
08/06/88	18:19	-0.31	- -	42	406.06	51.8			
16/06/88	- -	- -	- -	41.3	- -	- -		- dry	
20/06/88	- -	- -	- -	- -	- -	- -		- system shutdown and removed from site.	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP13B-88			GROUND ELEV.: 205.6m AMSL		DEPTH OF SCREEN: 5.9 TO 7.2 (m BGS)		SCREENED ELEVATION: 199.7 TO 198.4 (m AMSL)		COMMENTS
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.					
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)					
04/03/88	16:00	0.12	-	54	408.83	30	- system start-up - 50cfm				
08/03/88	9:35	0.08	83	56	412.04	32.7					
07/04/88	3:30	1	-	-							
09/05/88	10:08	0.15	-	-	405.01	65.66					
09/05/88	11:10	-0.4	-	-	404.97	64.22	- SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading				
09/05/88	11:17	-0.45	-	-	404.97	64.22					
09/05/88	11:21	-0.45	-	-	404.97	64.22					
09/05/88	11:42	-0.4	-	-	404.97	64.22					
09/05/88	13:02	-0.4	-	-	404.61	64.76	- system decreased to 40 cfm - system increased to 50 cfm - SLOW - SLOW				
09/05/88	14:32	-	-	47	404.45	64.76					
10/05/88	9:57	-0.46	-	48	404.09	61.88					
11/05/88	10:33	-0.28	-	44	409.27	52.88					
13/05/88	11:05	-0.3	-	40	406.62	48.56	- system decreased to 40 cfm - system increased to 60 cfm : SLOW - SLOW				
16/05/88	13:42	-0.33	-	45	405.13	59					
18/05/88	10:52	-0.35	-	42	409.47	50.72					
20/05/88	13:10	-0.4	-	42	407.38	62.78					
24/05/88	11:51	-0.32	-	46	406.18	55.58	- system decreased to 40 cfm - system increased to 60 cfm : SLOW - SLOW				
25/05/88	12:40	-0.63	-	-	408.91	49.64					
25/05/88	14:31	-0.67	-	46	408.67	53.42					
27/05/88	12:00	-0.57	-	34	408.79	74.48					
27/05/88	13:50	-0.3	-	-	408.71	75.02	- system decreased to 36 cfm - SLOW - SLOW - SLOW				
27/05/88	14:10	-0.3	-	-	408.59	77.9					
30/05/88	18:14	-0.27	-	41	408.11	85.64					
01/06/88	18:13	-0.35	-	38	405.17	70.34					
03/06/88	18:16	-0.33	-	33	407.99	71.7	- dry - system shutdown and removed from site.				
05/06/88	14:40	-0.22	-	32	405.9	79.34					
08/06/88	18:19	-0.31	-	36	406.06	51.8					
16/06/88	-	-	-	35.4	-	-					
20/06/88	-	-	-	-	-	-					

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP13C-88		GROUND ELEV.: 205.6m AMSL		DEPTH OF SCREEN: 3.6 TO 4.8 (m BGS)	
PAGE 1		SCREENED ELEVATION: 202.0 TO 200.8 (m AMSL)			
DATE	TIME	PRES.	TEMP.	METH.	ATMOS.
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O) (DEG. F)
04/03/88	16:00	0	- -	57	30
08/03/88	9:40	0	68	58	32.7
07/04/88	3:30	0.15	- -	- -	
09/05/88	10:10	0.05	- -	- -	65.66
09/05/88	11:10	0	- -	- -	64.22
09/05/88	11:17	0	- -	- -	64.22
09/05/88	11:21	0	- -	- -	64.22
09/05/88	11:42	0	- -	- -	64.22
09/05/88	13:02	0	- -	- -	64.76
09/05/88	14:38	- -	- -	56	64.76
10/05/88	10:04	-0.48	- -	58	61.88
11/05/88	10:44	0	- -	60	52.88
13/05/88	11:15	-0.38	- -	57	48.56
16/05/88	13:53	-0.05	- -	57	59
18/05/88	11:02	-0.03	- -	60	50.72
20/05/88	13:25	-0.03	- -	52	62.78
24/05/88	11:51	-0.03	- -	62	55.58
25/05/88	12:40	-0.05	- -	- -	49.64
25/05/88	14:31	-0.07	- -	60	53.42
27/05/88	12:00	-0.03	- -	58	74.48
27/05/88	13:50	-0.03	- -	- -	75.02
27/05/88	14:10	-0.03	- -	- -	77.9
30/05/88	18:14	-0.02	- -	59	85.64
01/06/88	18:13	-0.05	- -	56	70.34
03/06/88	18:16	-0.03	- -	58	71.7
05/06/88	14:40	0.03	- -	54	79.34
08/06/88	18:19	-0.03	- -	58	51.8
16/06/88	- -	- -	- -	28.5	- -
20/06/88	- -	- -	- -	- -	- -
					- system start-up - 50cfm
					- SLOW : takes a long time to get a reading
					- SLOW : takes a long time to get a reading
					- SLOW : takes a long time to get a reading
					- system decreased to 40 cfm
					- system increased to 50 cfm
					- SLOW
					- SLOW
					- system decreased to 40 cfm
					- system increased to 60 cfm : SLOW
					- SLOW
					- system decreased to 36 cfm
					- SLOW
					- SLOW
					- SLOW
					- dry
					- system shutdown and removed from site.

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP14 A-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 9.1 TO 10.7 (m BGS)		SCREENED ELEVATION: 196.7 TO 195.1 (m AMSL)			
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS				
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)					
04/03/88	16:00	0.45	- -	0	409.23	30.4	- system start-up - 50cfm				
08/03/88	9:10	0	101	0	412.04	32.7					
07/04/88	3:30	- -	- -	- -							
09/05/88	10:10	0.1	- -	- -	405.01	65.66	- SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading				
09/05/88	11:12	0.2	- -	- -	404.97	64.22					
09/05/88	11:18	0.25	- -	- -	404.97	64.22					
09/05/88	11:22	0.45	- -	- -	404.97	64.22					
09/05/88	11:43	0.3	- -	- -	404.97	64.22					
09/05/88	13:03	0.4	- -	- -	404.61	64.76					
09/05/88	14:38	- -	- -	0	404.45	64.76					
10/05/88	10:04	0.17	- -	0	404.09	61.88					
11/05/88	10:46	0.1	- -	0	409.27	52.88					
13/05/88	10:50	0	- -	0	404.65	58.6					
16/05/88	13:55	0.11	- -	0	405.13	59	- system decreased to 40 cfm - system increased to 50 cfm - SLOW				
18/05/88	11:03	0.25	- -	0	409.47	50.72					
20/05/88	13:26	0.15	- -	0	407.38	62.78	- system decreased to 40 cfm - system increased to 60 cfm : SLOW				
24/05/88	11:59	0.02	- -	0	406.18	55.58					
25/05/88	12:42	0.05	- -	- -	408.91	49.64	- system decreased to 36 cfm				
25/05/88	14:43	0	- -	0	408.67	53.42					
27/05/88	12:10	0.05	- -	0	408.79	74.48	- bulb collapses				
27/05/88	13:52	0.14	- -	- -	408.71	75.02					
27/05/88	14:12	0.25	- -	- -	408.59	77.9					
30/05/88	18:19	0.1	- -	0	408.11	85.64	- system shutdown and removed from site.				
01/06/88	18:19	0.05	- -	0	405.17	70.34					
03/06/88	18:21	0.05	- -	0	407.99	71.7					
05/06/88	14:50	0.1	- -	0	405.9	79.34					
08/06/88	18:27	0.08	- -	0	406.06	51.8					
20/06/88	- -	- -	- -	- -	- -	- -					

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP14B -88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 6.4 TO 7.7 (m BGS)			
PAGE 1				SCREENED ELEVATION: 199.4 TO 198.1 (m AMSL)			
DATE	TIME	PRES. (IN. H2O)	TEMP. (DEG. F)	METH.	ATMOS. PRES. (IN. H2O)	ATMOS. TEMP. (DEG. F)	COMMENTS
(D/M/Y)				(% VOL.)			
04/03/88	16:00	0.1	-	54	409.23	30.4	- system start-up - 50cfm
08/03/88	9:20	0.1	83	54	412.04	32.7	
07/04/88	3:30	0.6	-	-			
09/05/88	10:10	0.1	-	-	405.01	65.66	
09/05/88	11:12	-0.25	-	-	404.97	64.22	- SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading
09/05/88	11:18	-0.3	-	-	404.97	64.22	
09/05/88	11:22	-0.3	-	-	404.97	64.22	
09/05/88	11:43	-0.25	-	-	404.97	64.22	
09/05/88	13:03	-0.25	-	-	404.61	64.76	- SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading
09/05/88	14:38	-	-	44	404.45	64.76	
10/05/88	10:04	-0.28	-	49	404.09	61.88	
11/05/88	10:58	-0.15	-	44	409.27	52.88	
13/05/88	10:50	-0.18	-	50	404.65	58.6	- system decreased to 40 cfm - system increased to 50 cfm - SLOW - SLOW
16/05/88	13:55	-0.22	-	51	405.13	59	
18/05/88	11:03	-0.2	-	49	409.47	50.72	
20/05/88	13:26	-0.27	-	47	407.38	62.78	
24/05/88	11:59	-0.18	-	52	406.18	55.58	- system decreased to 40 cfm - system increased to 60 cfm : SLOW - SLOW - system decreased to 36 cfm
25/05/88	12:42	-0.41	-	-	408.91	49.64	
25/05/88	14:43	-0.4	-	54	408.67	53.42	
27/05/88	12:10	-0.36	-	42	408.79	74.48	
27/05/88	13:52	-0.18	-	-	408.71	75.02	- SLOW - SLOW - SLOW - SLOW
27/05/88	14:12	-0.17	-	-	408.59	77.9	
30/05/88	18:19	-0.16	-	47	408.11	85.64	
01/06/88	18:19	-0.27	-	51	405.17	70.34	
03/06/88	18:21	-0.22	-	41	407.99	71.7	- system shutdown and removed from site.
05/06/88	14:50	-0.05	-	41	405.9	79.34	
08/06/88	18:27	-0.26	-	41	406.06	51.8	
20/06/88	-	-	-	-	-	-	

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP14C-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 3.4 TO 4.6 (m BGS)		SCREENED ELEVATION: 202.4 TO 201.2 (m AMSL)		COMMENTS
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.				
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)				
04/03/88	16:00	0.05	-	53	409.23	30.4	- system start-up - 50cfm			
08/03/88	9:25	0.05	68	54	412.04	32.7				
07/04/88	3:30	0.2	-	-						
09/05/88	10:13	0.05	-	-	405.01	65.66				
09/05/88	11:12	-0.1	-	-	404.97	64.22	- SLOW : takes a long time to get a reading - SLOW : takes a long time to get a reading			
09/05/88	11:18	-0.1	-	-	404.97	64.22				
09/05/88	11:22	-0.1	-	-	404.97	64.22				
09/05/88	11:43	-0.05	-	-	404.97	64.22				
09/05/88	13:03	-0.05	-	-	404.61	64.76	- system decreased to 40 cfm - system increased to 50 cfm			
09/05/88	14:44	-	-	54	404.45	64.76				
10/05/88	10:15	-0.17	-	60	404.09	61.88				
11/05/88	10:56	-0.05	-	55	409.27	52.88				
13/05/88	10:00	-0.05	-	50	404.65	58.6	- SLOW - system decreased to 40 cfm - system increased to 60 cfm : SLOW			
16/05/88	14:05	-0.05	-	60	405.13	59				
18/05/88	11:12	-0.07	-	60	409.47	50.72				
20/05/88	13:26	-0.08	-	57	407.38	62.78				
24/05/88	11:59	-0.03	-	62	406.18	55.58	- system decreased to 36 cfm - SLOW - SLOW - SLOW			
25/05/88	12:42	-0.13	-	-	408.91	49.64				
25/05/88	14:43	-0.17	-	61	408.67	53.42				
27/05/88	12:10	-0.17	-	57	408.79	74.48				
27/05/88	13:52	-0.07	-	-	408.71	75.02	- system shutdown and removed from site.			
27/05/88	14:12	-0.04	-	-	408.59	77.9				
30/05/88	18:19	-0.02	-	60	408.11	85.64				
01/06/88	18:19	-0.1	-	58	405.17	70.34				
03/06/88	18:27	-0.07	-	60	407.99	71.7	- system shutdown and removed from site.			
05/06/88	14:50	0.02	-	56	405.9	79.34				
08/06/88	18:27	-0.07	-	61	406.06	51.8				
20/06/88	-	-	-	-	-	-				

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP15A-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 11.1 TO 12.3 (m BGS)			
PAGE 1		SCREENED ELEVATION: 194.7 TO 193.5 (m AMSL)					
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)	
04/03/88	16:00	0.2	- -	0	409.23	30.4	- pressure drops off over time
08/03/88	8:55	0	106	0	412.04	30.7	
07/04/88	3:30	- -	- -	- -			
09/05/88	10:13	0	- -	- -	405.01	65.66	- system start-up - 50cfm
09/05/88	11:13	0	- -	- -	404.97	64.22	
09/05/88	11:19	0	- -	- -	404.97	64.22	
09/05/88	11:22	0.45	- -	- -	404.97	64.22	- SLOW : takes a long time to get a reading
09/05/88	11:44	0.85	- -	- -	404.97	64.22	
09/05/88	13:04	0.6	- -	- -	404.61	64.76	
09/05/88	14:45	- -	- -	0	404.45	64.76	- system decreased to 40 cfm
10/05/88	10:16	0	- -	0	404.09	61.88	
11/05/88	10:58	0.15	- -	0	409.27	52.88	
13/05/88	10:35	0.05	- -	0	404.65	58.6	- system increased to 50 cfm
16/05/88	14:42	0.4	- -	0	404.33	63.32	
18/05/88	11:13	0.12	- -	0	409.47	50.72	
20/05/88	13:33	0.78	- -	0	407.42	61.88	- system decreased to 40 cfm
24/05/88	12:05	0	- -	0	406.22	58.28	
25/05/88	12:44	0	- -	- -	408.91	49.64	
25/05/88	14:54	0.05	- -	0	408.67	53.42	- system increased to 60 cfm : SLOW
27/05/88	12:20	-0.14	- -	51	408.79	74.48	
27/05/88	13:55	0.1	- -	- -	408.71	75.02	
27/05/88	14:15	0.15	- -	- -	408.59	77.9	- system decreased to 36 cfm
30/05/88	18:24	0.1	- -	0	408.11	85.64	
01/06/88	18:24	0	- -	0	405.17	70.34	
03/06/88	18:27	0	- -	0	407.99	71.7	- bulb collapses
05/06/88	14:56	0.07	- -	0	405.9	79.34	
08/06/88	18:31	0.06	- -	0	406.06	51.8	
20/06/88	- -	- -	- -	- -	- -	- -	- system shutdown and removed from site.

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP15 B-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 6.6 TO 7.9 (m BGS)		SCREENED ELEVATION: 199.2 TO 197.9 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O) (DEG. F)	(% VOL.)		(IN. H2O)	(DEG. F)			
04/03/88	16:00	0.1	-	56	409.23	30.4			
08/03/88	9:00	0.1	97	56	412.04	32.7			
07/04/88	3:30	0.3	-	-					
09/05/88	10:13	0.1	-	-	405.01	65.66			
09/05/88	11:13	-0.05	-	-	404.97	64.22		- system start-up - 50cfm	
09/05/88	11:19	-0.1	-	-	404.97	64.22			
09/05/88	11:22	-0.1	-	-	404.97	64.22			
09/05/88	11:44	-0.05	-	-	404.97	64.22			
09/05/88	13:04	-0.1	-	-	404.61	64.76			
09/05/88	14:45	-	-	50	404.45	64.76		- SLOW : takes a long time to get a reading	
10/05/88	10:16	-0.12	-	52	404.09	61.88			
11/05/88	10:58	-0.05	-	53	409.27	52.88		- SLOW : takes a long time to get a reading	
13/05/88	10:35	-0.06	-	51	404.65	58.6			
16/05/88	14:47	0.12	-	52	404.33	63.32		- system decreased to 40 cfm	
18/05/88	11:13	-0.07	-	53	409.47	50.72		- system increased to 50 cfm	
20/05/88	13:33	-0.1	-	46	407.42	61.88			
24/05/88	12:05	-0.04	-	58	406.22	58.28		- SLOW	
25/05/88	12:44	-0.17	-	-	408.91	49.64		- system decreased to 40 cfm	
25/05/88	14:54	-0.15	-	54	408.67	53.42		- system increased to 60 cfm : SLOW	
27/05/88	12:20	-0.14	-	51	408.79	74.48		- SLOW	
27/05/88	13:55	-0.06	-	-	408.71	75.02		- system decreased to 36 cfm	
27/05/88	14:15	-0.04	-	-	408.59	77.9			
30/05/88	18:24	-0.06	-	53	408.11	85.64		- SLOW	
01/06/88	18:24	-0.15	-	52	405.17	70.34			
03/06/88	18:27	-0.09	-	53	407.99	71.7			
05/06/88	14:56	0	-	52	405.9	79.34			
08/06/88	18:31	-0.11	-	52	406.06	51.8		- system shutdown and removed from site.	
20/06/88	-	-	-	-	-	-			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP15C-88			GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 3.1 TO 4.4 (m BGS)		SCREENED ELEVATION: 202.7 TO 201.4 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS			
(D/M/Y)		(IN. H20) (DEG. F)	(% VOL.)		(IN. H20)	(DEG. F)				
04/03/88	16:00	0.05	-	56	409.23	30.4	- system start-up - 50cfm			
08/03/88	9:10	0.05	65	58	412.04	32.7				
07/04/88	3:30	0.3	-	-						
09/05/88	10:15	0.05	-	-	405.01	65.66				
09/05/88	11:13	-0.1	-	-	404.97	64.22				
09/05/88	11:19	-0.15	-	-	404.97	64.22				
09/05/88	11:22	-0.15	-	-	404.97	64.22				
09/05/88	11:44	-0.1	-	-	404.97	64.22				
09/05/88	13:04	-0.1	-	-	404.61	64.76	- SLOW : takes a long time to get a reading			
09/05/88	14:50	-	-	51	404.45	64.76				
10/05/88	10:22	-0.19	-	44	404.09	61.88				
11/05/88	11:05	-0.05	-	54	409.27	52.88				
13/05/88	10:45	-0.08	-	52	404.65	58.6	- SLOW : takes a long time to get a reading			
16/05/88	14:53	0.08	-	55	404.33	63.32				
18/05/88	11:20	-0.05	-	55	409.47	50.72				
20/05/88	13:33	-0.1	-	52	407.42	61.88				
24/05/88	12:05	-0.04	-	59	406.22	58.28	- SLOW			
25/05/88	12:44	-0.18	-	-	408.91	49.64				
25/05/88	14:54	-0.17	-	51	408.67	53.42				
27/05/88	12:20	-0.15	-	54	408.79	74.48				
27/05/88	13:55	-0.07	-	-	408.71	75.02	- system decreased to 40 cfm			
27/05/88	14:15	-0.06	-	-	408.59	77.9				
30/05/88	18:24	-0.07	-	53	408.11	85.64				
01/06/88	18:24	-0.15	-	53	405.17	70.34				
03/06/88	18:27	-0.09	-	54	407.99	71.7	- system decreased to 60 cfm			
05/06/88	14:56	0	-	55	405.9	79.34				
08/06/88	18:31	-0.11	-	54	406.06	51.8				
20/06/88	-	-	-	-	-	-				
							- system shutdown and removed from site.			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP16A-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 12.5 TO 13.7 (m BGS)		SCREENED ELEVATION: 193.3 TO 192.1 (m AMSL)	
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS		
(D/M/Y)		(IN. H2O)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)			
04/03/88	17:30	>10	- -	18	409.23	30.4	- meth. drops off over time, builds pres. - methane fluctuates		
08/03/88	8:45	- -	64	24	412.04	30.7			
07/04/88	3:30	- -	- -	- -			- fluctuating between 1 and 3 - system start-up - 50cfm		
09/05/88	10:15	2	- -	- -	405.01	65.66			
09/05/88	11:15	>1	- -	- -	404.97	64.22	- pressure fluctuates between 1-2-0 -pressure fluctuates between 0.25 and 0.75 - system decreased to 40 cfm - system incr to 50 cfm (press. varies meth. drops) - pressure fluctuates - pressure fluctuates between 0 and +2 - system decr. to 40 cfm (press. varies from 0 to 1) - system incr. to 60 cfm (press. varies from 0 to 1) - pressure fluctuates between 0 and 1.5 - system decreased to 36 cfm		
09/05/88	11:20	0.3	- -	- -	404.97	64.22			
09/05/88	11:23	>1	- -	- -	404.97	64.22			
09/05/88	11:45	>1	- -	- -	404.97	64.22			
09/05/88	13:05	>1	- -	- -	404.61	64.76			
09/05/88	14:50	- -	- -	53	404.45	64.76			
10/05/88	10:23	0	- -	54	404.09	61.88			
11/05/88	11:06	1	- -	53	409.27	52.88			
13/05/88	10:20	0.5	- -	45	404.65	58.6			
16/05/88	14:30	2	- -	56	404.33	63.32			
18/05/88	11:21	0.8	- -	42	409.47	50.72			
20/05/88	13:40	1	- -	58	407.42	61.88			
24/05/88	12:11	1	- -	54	406.22	58.28			
25/05/88	12:46	0.5	- -	- -	408.91	49.64			
25/05/88	15:03	0.5	- -	51	408.51	54.86			
27/05/88	12:30	0.75	- -	55	408.79	74.48			
27/05/88	13:57	>1	- -	- -	408.71	75.02			
27/05/88	14:18	>1	- -	- -	408.59	77.9			
30/05/88	18:30	>1	- -	58	408.11	85.64			
01/06/88	18:30	>1	- -	50	405.17	70.34			
03/06/88	18:31	0.5	- -	52	407.99	71.7			
05/06/88	15:03	>1	- -	52	405.62	79.88			
08/06/88	18:35	>1	- -	57	406.06	51.8			
20/06/88	- -	- -	- -	- -	- -	- -			

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

PAGE 1		GP16B-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 6.4 TO 7.6 (m BGS)		SCREENED ELEVATION: 199.4 TO 198.3 (m AMSL)		COMMENTS
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.				
(D/M/Y)		(IN. H2O) (DEG. F)	(DEG. F)	(% VOL.)	(IN. H2O)	(DEG. F)				
04/03/88	17:30	0.1	-	42	409.23	30.4	- system start-up - 50cfm			
08/03/88	8:47	0.1	94	53	412.04	30.7				
07/04/88	3:30	0.1	-	-						
09/05/88	10:15	0.1	-	-	405.01	65.66				
09/05/88	11:15	0	-	-	404.97	64.22				
09/05/88	11:20	0	-	-	404.97	64.22				
09/05/88	11:23	0	-	-	404.97	64.22				
09/05/88	11:45	0.05	-	-	404.97	64.22				
09/05/88	13:05	0	-	-	404.61	64.76				
09/05/88	14:50	-	-	53	404.45	64.76				
10/05/88	10:23	0	-	60	404.09	61.88				
11/05/88	11:06	0	-	62	409.27	52.88				
13/05/88	10:20	0	-	60	404.65	58.6				
16/05/88	14:35	0.2	-	58	404.33	63.32		- system decreased to 40 cfm		
18/05/88	11:21	0.05	-	60	409.47	50.72		- system increased to 50 cfm		
20/05/88	13:40	0	-	58	407.42	61.88				
24/05/88	12:11	0.04	-	66	406.22	58.28				
25/05/88	12:46	0.04	-	-	408.91	49.64		- system decreased to 40 cfm		
25/05/88	15:03	-0.05	-	64	408.51	54.86		- system increased to 60 cfm		
27/05/88	12:30	-0.02	-	52	408.79	74.48				
27/05/88	13:57	0.03	-	-	408.71	75.02		- system decreased to 36 cfm		
27/05/88	14:18	0.04	-	-	408.59	77.9				
30/05/88	18:30	0.02	-	56	408.11	85.64		- SLOW		
01/06/88	18:30	-0.05	-	56	405.17	70.34				
03/06/88	18:31	0	-	58	407.99	71.7				
05/06/88	15:03	0.1	-	56	405.62	79.88				
08/06/88	18:35	-0.03	-	61	406.06	51.8				
20/06/88	-	-	-	-	-	-		- system shutdown and removed from site.		

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

GP16C-88		GROUND ELEV.: 205.8m AMSL		DEPTH OF SCREEN: 2.2 TO 3.4 (m BGS)		SCREENED ELEVATION: 203.6 TO 202.4 (m AMSL)		
PAGE 1								
DATE	TIME	PRES.	TEMP.	METH.	ATMOS. PRES.	ATMOS. TEMP.	COMMENTS	
(D/M/Y)		(IN. H20)	(DEG. F)	(% VOL.)	(IN. H20)	(DEG. F)		
04/03/88	17:30	0	-	52	409.23	30.4	- system start-up - 50cfm	
08/03/88	8:50	0	103	54	412.04	30.7		
07/04/88	3:30	0.1	-	-				
09/05/88	10:15	0.05	-	-	405.01	65.66		
09/05/88	11:15	0	-	-	404.97	64.22		
09/05/88	11:20	0	-	-	404.97	64.22		
09/05/88	11:23	0	-	-	404.97	64.22		
09/05/88	11:45	0	-	-	404.97	64.22		
09/05/88	13:05	0	-	-	404.61	64.76		
09/05/88	14:53	-	-	51	404.45	64.76		
10/05/88	10:27	0	-	52	404.09	61.88	- system decreased to 40 cfm - system increased to 50 cfm	
11/05/88	11:10	0	-	52	409.27	52.88		
13/05/88	10:30	0	-	54	404.65	58.6		
16/05/88	14:40	0.14	-	54	404.33	63.32		
18/05/88	11:30	0	-	56	409.47	50.72		
20/05/88	13:40	0	-	55	407.42	61.88		
24/05/88	12:11	0	-	61	406.22	58.28		
25/05/88	12:46	-0.05	-	-	408.91	49.64		
25/05/88	15:03	-0.05	-	56	408.51	54.86		
27/05/88	12:30	-0.02	-	54	408.79	74.48		
27/05/88	13:57	0.03	-	-	408.71	75.02	- system decreased to 40 cfm - system increased to 60 cfm - system decreased to 36 cfm	
27/05/88	14:18	0.02	-	-	408.59	77.9		
30/05/88	18:30	0	-	55	408.11	85.64		
01/06/88	18:30	-0.02	-	55	405.17	70.34		
03/06/88	18:31	0	-	56	407.99	71.7		
05/06/88	15:03	0.07	-	54	405.62	79.88		
08/06/88	18:35	-0.02	-	56	406.06	51.8		
20/06/88	-	-	-	-	-	-		
								- system shutdown and removed from site.

- system start-up - 50cfm

- system decreased to 40 cfm
- system increased to 50 cfm

- system decreased to 40 cfm
- system increased to 60 cfm

- system decreased to 36 cfm

- system shutdown and removed from site.

NOTES: * - GENERAL NOTES FOR PROBE, --- NOT MEASURED

APPENDIX D

WEATHER INFORMATION SUMMARY

MOUNT HOPE AIRPORT

TABLE D1 - WEATHER SUMMARY

MARCH 2/88 to MARCH 8/88

MAY 8/88 TO MAY 14/88

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF	DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
Mar. 2/88	6:00	101.5	407.62	-5.7	21.7	May 8/88	5:00	- -	- -	5.5	41.9
	7:00	101.4	407.22	-5.3	22.5		6:00	101.75	408.63	4.9	40.82
	8:00	101.4	407.22	-2.9	26.8		7:00	101.8	408.83	5.7	42.26
	9:00	101.3	406.82	3.2	37.8		8:00	101.79	408.79	9.4	48.92
	10:00	101.2	406.42	5.4	41.7		9:00	101.8	408.83	12.6	54.68
	11:00	101.2	406.42	5.7	42.3		10:00	101.79	408.79	16.2	61.16
	12:00	101.1	406.02	7.2	45.0		11:00	101.71	408.47	19.7	67.46
	13:00	101.1	406.02	7.3	45.1		12:00	101.63	408.15	21.2	70.16
	14:00	101.1	406.02	7	44.6		13:00	101.59	407.99	22.5	72.5
	15:00	101.2	406.42	6.1	43.0		14:00	101.49	407.58	24.3	75.74
	16:00	101.2	406.42	5.2	41.4		15:00	101.44	407.38	24.6	76.28
	17:00	101.3	406.82	4	39.2		16:00	101.35	407.02	25.1	77.18
	18:00	101.5	407.62	2.2	36.0		17:00	101.29	406.78	24.4	75.92
	19:00	101.7	408.43	1.3	34.3		18:00	101.26	406.66	25.1	77.18
	20:00	101.7	408.43	0	32.0		19:00	101.21	406.46	17.4	63.32
	21:00	101.8	408.83	-0.7	30.7		20:00	101.2	406.42	15.5	59.9
Mar. 3/88	6:00	102.2	410.43	-3.9	25.0		21:00	101.22	406.50	13.4	56.12
	7:00	102.3	410.84	-4.2	24.4	May 9/88	5:00	- -	- -	16.6	61.88
	8:00	102.3	410.84	-5	23.0		6:00	100.88	405.13	16.3	61.34
	9:00	102.3	410.84	-4.8	23.4		7:00	100.89	405.17	16.4	61.52
	10:00	102.4	411.24	-4.3	24.3		8:00	100.92	405.29	17.8	64.04
	11:00	102.3	410.84	-3.4	25.9		9:00	100.86	405.05	19	66.2
	12:00	102.3	410.84	-2.7	27.1		10:00	100.85	405.01	18.7	65.66
	13:00	102.2	410.43	-2.9	26.8		11:00	100.84	404.97	17.9	64.22
	14:00	102.1	410.03	-3	26.6		12:00	100.83	404.93	18	64.4
	15:00	102.1	410.03	-3.2	26.2		13:00	100.75	404.61	18.2	64.76
	16:00	102	409.63	-3.2	26.2		14:00	100.71	404.45	18.2	64.76
	17:00	102	409.63	-3.6	25.5		15:00	100.62	404.09	19.8	67.64
	18:00	102	409.63	-3.7	25.3		16:00	100.54	403.77	19.6	67.28
	19:00	102	409.63	-4.1	24.6		17:00	100.47	403.49	20.7	69.26
	20:00	101.9	409.23	-4.5	23.9		18:00	100.43	403.33	20.5	68.9
	21:00	101.9	409.23	-5	23.0		19:00	100.39	403.17	18.7	65.66
Mar. 4/88	6:00	101.8	408.83	-7.5	18.5		20:00	100.61	404.05	13.6	56.48
	7:00	101.8	408.83	-7.6	18.3	May 10/88	21:00	100.56	403.85	12.7	54.86
	8:00	102	409.63	-7.4	18.7		5:00	- -	- -	12.3	54.14
	9:00	101.9	409.23	-6.6	20.1		6:00	100.55	403.81	11.9	53.42
	10:00	101.9	409.23	-6.8	19.8		7:00	100.58	403.93	12.2	53.96
	11:00	101.9	409.23	-4.6	23.7		8:00	100.62	404.09	13.3	55.94
	12:00	101.9	409.23	-4.1	24.6		9:00	100.61	404.05	15.6	60.08
	13:00	101.9	409.23	-3.5	25.7		10:00	100.62	404.09	16.6	61.88
	14:00	101.8	408.83	-2.2	28.0		11:00	100.67	404.29	16.6	61.88
	15:00	101.8	408.83	-1.8	28.8		12:00	100.69	404.37	17.3	63.14
	16:00	101.8	408.83	-1.1	30.0		13:00	100.68	404.33	18.2	64.76
	17:00	101.9	409.23	-0.9	30.4		14:00	100.65	404.21	19.3	66.74
	18:00	102	409.63	-2.7	27.1		15:00	100.69	404.37	18.8	65.84
	19:00	102.1	410.03	-3.5	25.7		16:00	100.76	404.65	16	60.8
	20:00	102.1	410.03	-4.8	23.4		17:00	100.82	404.89	15.2	59.36
	21:00	102.2	410.43	-5.8	21.6		18:00	100.86	405.05	16.3	61.34
Mar. 5/88	6:00	102.8	412.84	-9.1	15.6		19:00	100.94	405.37	16.1	60.98
	7:00	102.8	412.84	-8.2	17.2	May 11/88	20:00	100.98	405.54	15	59
	8:00	102.9	413.25	-6.9	19.6		21:00	101.05	405.82	14.4	57.92
	9:00	102.9	413.25	-4.4	24.1		5:00	- -	- -	7.3	45.14
	10:00	102.9	413.25	-2	28.4		6:00	101.61	408.07	6.4	43.52
	11:00	102.9	413.25	-0.7	30.7		7:00	101.71	408.47	7.2	44.96
	12:00	102.9	413.25	1.4	34.5		8:00	101.8	408.83	8.4	47.12
	13:00	102.8	412.84	2.3	36.1		9:00	101.88	409.15	9.5	49.1
	14:00	102.8	412.84	2.5	36.5		10:00	101.91	409.27	11.6	52.88
	15:00	102.7	412.44	2.9	37.2		11:00	101.95	409.43	11.9	53.42
	16:00	102.6	412.04	2.5	36.5		12:00	101.99	409.59	13.5	56.3
	17:00	102.6	412.04	2.1	35.8		13:00	101.99	409.59	14.2	57.56
	18:00	102.5	411.64	0.3	32.5		14:00	101.96	409.47	14.2	57.56
	19:00	102.5	411.64	-1.2	29.8		15:00	101.94	409.39	15.4	59.72
	20:00	102.5	411.64	-2.2	28.0		16:00	101.92	409.31	16	60.8
	21:00	102.5	411.64	-3.3	26.1		17:00	101.92	409.31	16.5	61.7
Mar. 6/88	6:00	102.1	410.03	-4.8	23.4		18:00	101.91	409.27	16.2	61.16
	7:00	102.1	410.03	-5.3	22.5		19:00	101.92	409.31	15.7	60.26
	8:00	102	409.63	-3.4	25.9		20:00	101.96	409.47	14.4	57.92
	9:00	102	409.63	-1	30.2		21:00	102.03	409.75	11.4	52.52

TABLE D1 - WEATHER SUMMARY

MARCH 2/88 to MARCH 8/88 (cont'd)

MAY 8/88 TO MAY 14/88 (cont'd)

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF	DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
Mar. 6/88 cont'd	10:00	101.9	409.23	1.3	34.3	May 12/88	6:00	102.04	409.79	5.2	41.36
	11:00	101.9	409.23	3.1	37.6		7:00	102.07	409.91	6.2	43.16
	12:00	101.8	408.83	4.2	39.6		8:00	102.09	409.99	8.7	47.66
	13:00	101.7	408.43	4.9	40.8		9:00	102.1	410.03	13.3	55.94
	14:00	101.6	408.03	5.2	41.4		10:00	102.04	409.79	15.3	59.54
	15:00	101.5	407.62	5.6	42.1		11:00	102.02	409.71	16.5	61.7
	16:00	101.5	407.62	5.6	42.1		12:00	102.01	409.67	17.5	63.5
	17:00	101.4	407.22	4.8	40.6		13:00	101.97	409.51	17.3	63.14
	18:00	101.4	407.22	2.8	37.0		14:00	101.96	409.47	16.4	61.52
	19:00	101.4	407.22	1	33.8		15:00	101.86	409.07	16.8	62.24
	20:00	101.3	406.82	0.7	33.3		16:00	101.76	408.67	19.2	66.56
	21:00	101.3	406.82	0.8	33.4		17:00	101.69	408.39	18.9	66.02
Mar. 7/88	6:00	101.6	408.03	0	32.0		18:00	101.63	408.15	18.6	65.48
	7:00	101.6	408.03	0.1	32.2	May 13/88	19:00	101.58	407.95	18.5	65.3
	8:00	101.8	408.83	0.8	33.4		20:00	101.52	407.70	18	64.4
	9:00	101.9	409.23	2.1	35.8		21:00	101.5	407.62	17.1	62.78
	10:00	102	409.63	3.7	38.7		6:00	100.75	404.61	15.4	59.72
	11:00	102.1	410.03	4.4	39.9		7:00	100.74	404.57	16.7	62.06
	12:00	102.2	410.43	4.6	40.3		8:00	100.74	404.57	18.6	65.48
	13:00	102.2	410.43	4.9	40.8		9:00	100.76	404.65	19.1	66.38
	14:00	102.2	410.43	4.4	39.9		10:00	101	405.62	12	53.6
	15:00	102.3	410.84	5.1	41.2		11:00	101.25	406.62	9.2	48.56
	16:00	102.4	411.24	4.7	40.5		12:00	101.29	406.78	9	48.2
	17:00	102.4	411.24	4.5	40.1		13:00	101.41	407.26	10.3	50.54
Mar. 8/88	18:00	102.5	411.64	3.1	37.6		14:00	101.58	407.95	13.4	56.12
	19:00	102.6	412.04	1.7	35.1	May 14/88	15:00	101.62	408.11	14	57.2
	20:00	102.6	412.04	1	33.8		16:00	101.68	408.35	14.1	57.38
	21:00	102.6	412.04	-0.1	31.8		17:00	101.72	408.51	14.1	57.38
	6:00	102.7	412.44	-1.8	28.8		18:00	101.76	408.67	14.2	57.56
	7:00	102.7	412.44	-1.6	29.1		19:00	101.84	408.99	13.6	56.48
	8:00	102.6	412.04	-0.7	30.7		20:00	101.91	409.27	123	253.4
	9:00	102.6	412.04	0.4	32.7		21:00	101.94	409.39	10.1	50.18
	10:00	102.5	411.64	2.4	36.3		5:00	-	-	4.6	40.28
	11:00	102.4	411.24	3.7	38.7		6:00	102.18	410.35	4	39.2
	12:00	102.3	410.84	5.3	41.5		7:00	102.23	410.56	5.4	41.72
	13:00	102.2	410.43	4.9	40.8		8:00	102.3	410.84	7.2	44.96
	14:00	102	409.63	5.1	41.2		9:00	102.33	410.96	8.5	47.3
							10:00	102.33	410.96	9.6	49.28
							11:00	102.29	410.80	11.2	52.16
							12:00	102.25	410.64	13.1	55.58
							13:00	102.19	410.39	13.7	56.66
							14:00	102.18	410.35	14.4	57.92
							15:00	102.13	410.15	16	60.8
							16:00	102.1	410.03	16	60.8
							17:00	102.05	409.83	15.8	60.44
							18:00	102.01	409.67	15.6	60.08
							19:00	101.98	409.55	15.4	59.72
							20:00	101.94	409.39	13.8	56.84
							21:00	101.9	409.23	11.6	52.88

TABLE D1 - WEATHER SUMMARY

MAY 15/88 TO MAY 21/88

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
May 15/88	5:00	- -	- -	7.1	44.78
	6:00	101.35	407.02	6.9	44.42
	7:00	101.33	406.94	8.2	46.76
	8:00	101.36	407.06	10.8	51.44
	9:00	101.34	406.98	13.3	55.94
	10:00	101.26	406.66	16.5	61.7
	11:00	101.15	406.22	19.6	67.28
	12:00	101.1	406.02	22	71.6
	13:00	101.01	405.66	23.4	74.12
	14:00	101.01	405.66	21.6	70.88
	15:00	100.89	405.17	22.8	73.04
	16:00	100.8	404.81	24.3	75.74
	17:00	100.62	404.09	24.7	76.46
May 16/88	18:00	100.57	403.89	26.1	78.98
	19:00	100.45	403.41	24.7	76.46
	20:00	100.39	403.17	22.1	71.78
	21:00	100.33	402.93	22.4	72.32
	5:00	- -	- -	13.2	55.76
	6:00	100.49	403.57	13	55.4
	7:00	100.48	403.53	12.5	54.5
	8:00	100.5	403.61	14	57.2
	9:00	100.55	403.81	16.2	61.16
	10:00	100.59	403.97	18.2	64.76
	11:00	100.54	403.77	18.6	65.48
	12:00	100.6	404.01	17.6	63.68
	13:00	100.65	404.21	16	60.8
May 17/88	14:00	100.88	405.13	15	59
	15:00	100.68	404.33	17.4	63.32
	16:00	100.61	404.05	18.9	66.02
	17:00	100.63	404.13	18.7	65.66
	18:00	100.7	404.41	19.6	67.28
	19:00	100.7	404.41	19.3	66.74
	20:00	100.8	404.81	18.1	64.58
	21:00	100.86	405.05	16.1	60.98
	5:00	- -	- -	11.3	52.34
	6:00	101.16	406.26	10.9	51.62
	7:00	101.27	406.70	10.6	51.08
	8:00	101.32	406.90	10.4	50.72
	9:00	101.37	407.10	11.7	53.06
	10:00	101.43	407.34	11.9	53.42
May 18/88	11:00	101.51	407.66	11.9	53.42
	12:00	101.53	407.74	12.3	54.14
	13:00	101.54	407.78	13	55.4
	14:00	101.57	407.90	12.1	53.78
	15:00	101.57	407.90	12.7	54.86
	16:00	101.52	407.70	13.1	55.58
	17:00	101.56	407.86	12.4	54.32
	18:00	101.58	407.95	11.7	53.06
	19:00	101.62	408.11	10.4	50.72
	20:00	101.7	408.43	10.5	50.9
	21:00	101.71	408.47	9.7	49.46
	5:00	- -	- -	9.5	49.1
	6:00	101.78	408.75	9.7	49.46
	7:00	101.84	408.99	9.2	48.56
	8:00	101.88	409.15	10.3	50.54
	9:00	101.91	409.27	10.2	50.36
	10:00	101.94	409.39	10	50
	11:00	101.96	409.47	10.4	50.72
	12:00	101.93	409.35	12.1	53.78
	13:00	101.9	409.23	12.8	55.04
	14:00	101.85	409.03	14.1	57.38
	15:00	101.83	408.95	13.8	56.84
	16:00	101.78	408.75	14.4	57.92
	17:00	101.76	408.67	13.4	56.12
	18:00	101.74	408.59	11.6	52.88
	19:00	101.75	408.63	10.7	51.26
	20:00	101.76	408.67	10.3	50.54
	21:00	101.75	408.63	10	50

MAY 22/88 TO MAY 28/88

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
May 22/88	5:00	- -	- -	11.6	52.88
	6:00	101.54	407.78	11.5	52.7
	7:00	101.57	407.90	13.1	55.58
	8:00	101.59	407.99	14.3	57.74
	9:00	101.62	408.11	14.7	58.46
	10:00	101.62	408.11	15.5	59.9
	11:00	101.64	408.19	18.4	65.12
	12:00	101.61	408.07	20	68
	13:00	101.55	407.82	21.6	70.88
	14:00	101.48	407.54	22.5	72.5
	15:00	101.44	407.38	22.2	71.96
	16:00	101.40	407.22	23.1	73.58
	17:00	101.35	407.02	23.8	74.84
May 23/88	18:00	101.32	406.90	23.5	74.3
	19:00	101.28	406.74	21.6	70.88
	20:00	101.30	406.82	21.2	70.16
	21:00	101.33	406.94	18.5	65.3
	5:00	- -	- -	14.4	57.92
	6:00	101.16	406.26	13.4	56.12
	7:00	101.17	406.30	14.3	57.74
	8:00	101.19	406.38	17.2	62.96
	9:00	101.2	406.42	19.2	66.56
	10:00	101.21	406.46	18.9	66.02
	11:00	101.24	406.58	20.4	68.72
	12:00	101.18	406.34	21.5	70.7
	13:00	101.12	406.10	23.4	74.12
May 24/88	14:00	101.04	405.78	24.2	75.56
	15:00	100.98	405.54	24.8	76.64
	16:00	100.91	405.25	24.9	76.82
	17:00	100.83	404.93	25.1	77.18
	18:00	100.8	404.81	24.7	76.46
	19:00	100.79	404.77	22.5	72.5
	20:00	100.84	404.97	20.1	68.18
	21:00	100.86	405.05	18.5	65.3
	5:00	- -	- -	13.3	55.94
	6:00	100.92	405.29	13	55.4
	7:00	100.95	405.41	12.5	54.5
	8:00	101.06	405.86	11.8	53.24
	9:00	101.07	405.90	12.5	54.5
	10:00	101.09	405.98	12.9	55.22
May 25/88	11:00	101.14	406.18	13.1	55.58
	12:00	101.15	406.22	14.6	58.28
	13:00	101.1	406.02	15.7	60.26
	14:00	101.08	405.94	16.1	60.98
	15:00	101.05	405.82	17.8	64.04
	16:00	100.99	405.58	17.9	64.22
	17:00	100.95	405.41	18.2	64.76
	18:00	100.96	405.46	18.2	64.76
	19:00	101.02	405.70	16	60.8
	20:00	101.14	406.18	14.7	58.46
	21:00	100.19	402.36	13.3	55.94
	5:00	- -	- -	4.9	40.82
	6:00	101.53	407.74	4.4	39.92
	7:00	101.6	408.03	3.9	39.02
	8:00	101.72	408.51	5.5	41.9
	9:00	101.77	408.71	6.6	43.88
	10:00	101.8	408.83	8.3	46.94
	11:00	101.82	408.91	9.1	48.38
	12:00	101.82	408.91	9.8	49.64
	13:00	101.81	408.87	11.2	52.16
	14:00	101.76	408.67	11.9	53.42
	15:00	101.72	408.51	12.7	54.86
	16:00	101.71	408.47	13.3	55.94
	17:00	101.75	408.63	13.9	57.02
	18:00	101.78	408.75	13.6	56.48
	19:00	101.79	408.79	13.3	55.94
	20:00	101.86	409.07	11.9	53.42
	21:00	101.89	409.19	10.2	50.36

TABLE D1 - WEATHER SUMMARY

MAY 15/88 TO MAY 21/88 (cont'd)

MAY 22/88 TO MAY 28/88 (cont'd)

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF	DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
May 19/88	5:00	- -	- -	9.2	48.56	May 26/88	5:00	- -	- -	2.5	36.5
	6:00	101.57	407.90	8.8	47.84		6:00	102	409.63	2.7	36.86
	7:00	101.57	407.90	8.6	47.48		7:00	102.05	409.83	4.8	40.64
	8:00	101.53	407.74	9	48.2		8:00	102.07	409.91	6.8	44.24
	9:00	101.6	408.03	8.7	47.66		9:00	102.09	409.99	10.2	50.36
	10:00	101.63	408.15	8.9	48.02		10:00	102.11	410.07	11.4	52.52
	11:00	101.61	408.07	9.8	49.64		11:00	102.09	409.99	14.8	58.64
	12:00	101.64	408.19	9.9	49.82		12:00	102.03	409.75	15.7	60.26
	13:00	101.62	408.11	10.5	50.9		13:00	101.99	409.59	17.1	62.78
	14:00	101.55	407.82	10.1	50.18		14:00	101.93	409.35	17.8	64.04
	15:00	101.53	407.74	10	50		15:00	101.87	409.11	18.3	64.94
	16:00	101.54	407.78	10.5	50.9		16:00	1018	4088.29	18.9	66.02
	17:00	101.51	407.66	11.2	52.16		17:00	101.73	408.55	19.3	66.74
May 20/88	18:00	101.42	407.30	12.2	53.96		18:00	101.72	408.51	18.6	65.48
	19:00	101.45	407.42	11.4	52.52		19:00	101.71	408.47	17.6	63.68
	20:00	101.44	407.38	10.8	51.44		20:00	101.7	408.43	16.6	61.88
	21:00	101.45	407.42	10.1	50.18		21:00	101.69	408.39	14.4	57.92
	5:00	- -	- -	10.3	50.54	May 27/88	5:00	- -	- -	13.2	55.76
	6:00	101.43	407.34	10.3	50.54		6:00	101.75	408.63	12.8	55.04
	7:00	101.44	407.38	10.5	50.9		7:00	101.82	408.91	14.1	57.38
	8:00	101.47	407.50	11.6	52.88		8:00	101.84	408.99	16.2	61.16
	9:00	101.49	407.58	12.3	54.14		9:00	101.86	409.07	17.7	63.86
	10:00	101.49	407.58	13.1	55.58		10:00	101.85	409.03	19.9	67.82
	11:00	101.46	407.46	14.1	57.38		11:00	101.83	408.95	21.8	71.24
	12:00	101.45	407.42	15.4	59.72		12:00	101.79	408.79	23.6	74.48
	13:00	101.44	407.38	17.1	62.78		13:00	101.77	408.71	23.9	75.02
	14:00	101.45	407.42	17.5	63.5		14:00	101.74	408.59	25.5	77.9
	15:00	101.43	407.34	17.5	63.5		15:00	101.72	408.51	25.6	78.08
	16:00	101.38	407.14	17.2	62.96		16:00	101.72	408.51	25.6	78.08
	17:00	101.35	407.02	17.7	63.86		17:00	101.7	408.43	25.6	78.08
May 21/88	18:00	101.32	406.90	18	64.4		18:00	101.69	408.39	24.5	76.1
	19:00	101.33	406.94	17.8	64.04		19:00	101.66	408.27	23.8	74.84
	20:00	101.39	407.18	16.5	61.7		20:00	101.66	408.27	22.1	71.78
	21:00	101.43	407.34	15.6	60.08		21:00	101.65	408.23	19.8	67.64
	5:00	- -	- -	11.1	51.98	MAY 28/88	5:00	- -	- -	10.8	51.44
	6:00	101.43	407.34	11.4	52.52		6:00	101.74	408.59	10.6	51.08
	7:00	101.46	407.46	12.2	53.96		7:00	101.82	408.91	12.1	53.78
	8:00	101.48	407.54	12.5	54.5		8:00	101.85	409.03	13.6	56.48
	9:00	101.5	407.62	13.9	57.02		9:00	101.87	409.11	16.5	61.7
	10:00	101.5	407.62	14.7	58.46		10:00	101.87	409.11	20.2	68.36
	11:00	101.49	407.58	16.1	60.98		11:00	101.85	409.03	23.4	74.12
	12:00	101.5	407.62	16	60.8		12:00	101.82	408.91	25.8	78.44
	13:00	101.51	407.66	16.9	62.42		13:00	101.77	408.71	27.4	81.32
	14:00	101.5	407.62	17.1	62.78		14:00	101.71	408.47	27.8	82.04
	15:00	101.48	407.54	17.3	63.14		15:00	101.62	408.11	27.6	81.68
	16:00	101.45	407.42	17.5	63.5		16:00	101.57	407.90	27	80.6
	17:00	101.41	407.26	17.7	63.86		17:00	101.5	407.62	26.8	80.24
	18:00	101.39	407.18	18.2	64.76		18:00	101.52	407.70	26.5	79.7
	19:00	101.42	407.30	18	64.4		19:00	101.52	407.70	24.7	76.46
	20:00	101.44	407.38	17.1	62.78		20:00	101.59	407.99	23.1	73.58
	21:00	101.47	407.50	15.8	60.44		21:00	101.62	408.11	20.8	69.44

TABLE D1 - WEATHER SUMMARY

MAY 29/88 TO JUNE 4/88

JUNE 5/88 TO JUNE 8/88

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF	DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
May 29/88	5:00	-	-	13	55.4	June 5/88	5:00	-	-	10.1	50.18
	6:00	101.62	408.11	12.6	54.68		6:00	101.37	407.10	11.4	52.52
	7:00	101.66	408.27	13.5	56.3		7:00	101.34	406.98	13.4	56.12
	8:00	101.69	408.39	16.5	61.7		8:00	101.32	406.90	15.8	60.44
	9:00	101.73	408.55	19.2	66.56		9:00	101.3	406.82	18.1	64.58
	10:00	101.78	408.75	23.1	73.58		10:00	101.25	406.62	19	66.2
	11:00	101.78	408.75	25.1	77.18		11:00	101.22	406.50	20.4	68.72
	12:00	101.75	408.63	26.1	78.98		12:00	101.2	406.42	22.2	71.96
	13:00	101.72	408.51	27.6	81.68		13:00	101.13	406.14	24.6	76.28
	14:00	101.65	408.23	28.6	83.48		14:00	101.07	405.90	26.3	79.34
	15:00	101.58	407.95	28.8	83.84		15:00	101	405.62	26.6	79.88
	16:00	101.57	407.90	28	82.4		16:00	100.97	405.50	27.2	80.96
May 30/88	17:00	101.53	407.74	26.7	80.06	June 6/88	17:00	100.96	405.46	27.3	81.14
	18:00	101.5	407.62	26.4	79.52		18:00	100.92	405.29	27	80.6
	19:00	101.49	407.58	24.6	76.28		19:00	100.91	405.25	26.4	79.52
	20:00	101.5	407.62	22.3	72.14		20:00	100.92	405.29	25.3	77.54
	21:00	101.53	407.74	21.1	69.98		21:00	100.93	405.33	24.8	76.64
	5:00	-	-	15.6	60.08		5:00	-	-	15.4	59.72
	6:00	101.65	408.23	15.3	59.54		6:00	101.26	406.66	14.9	58.82
	7:00	101.58	408.35	17.1	62.78		7:00	101.36	407.06	15.5	59.9
	8:00	101.75	408.63	19.5	67.1		8:00	101.4	407.22	17.8	64.04
	9:00	101.77	408.71	22.8	73.04		9:00	101.44	407.38	19.9	67.82
	10:00	101.79	408.79	25.3	77.54		10:00	101.4	407.22	20.6	69.08
	11:00	101.78	408.75	27.4	81.32		11:00	101.36	407.06	22.3	72.14
May 31/88	12:00	101.78	408.75	29.5	85.1	June 7/88	12:00	101.34	406.98	23.8	74.84
	13:00	101.74	408.59	30.1	86.18		13:00	101.27	406.70	25.6	78.08
	14:00	101.7	408.43	30.5	86.9		14:00	101.18	406.34	27.4	81.32
	15:00	101.59	408.39	30.4	86.72		15:00	101.1	406.02	28.2	82.76
	16:00	101.66	408.27	31	87.8		16:00	101.02	405.70	27	80.6
	17:00	101.64	408.19	30.6	87.08		17:00	100.94	405.37	26.3	79.34
	18:00	101.62	408.11	29.8	85.64		18:00	100.87	405.09	28.5	83.3
	19:00	101.61	408.07	28.6	83.48		19:00	100.91	405.25	22.2	71.96
	20:00	101.56	408.27	27.5	81.5		20:00	100.97	405.50	21	69.8
	21:00	101.65	408.23	25.4	77.72		21:00	100.83	404.93	18.9	66.02
	5:00	-	-	15.4	59.72		5:00	-	-	13.8	56.84
	6:00	101.71	408.47	14.9	58.82	June 8/88	6:00	100.83	404.93	14	57.2
June 1/88	7:00	101.76	408.67	20.2	68.36		7:00	100.89	405.17	15.3	59.54
	8:00	101.77	408.71	20.9	69.62		8:00	100.83	#VALUE!	16	60.8
	9:00	101.78	408.75	22.8	73.04		9:00	100.84	404.97	17.7	63.86
	10:00	101.8	408.83	25	77		10:00	100.82	404.89	17.2	62.96
	11:00	101.79	408.79	26.2	79.16		11:00	100.92	405.29	15.8	60.44
	12:00	101.78	408.75	28.6	83.48		12:00	100.86	405.05	15.9	60.62
	13:00	101.73	408.55	29.6	85.28		13:00	100.83	404.93	15	59
	14:00	101.67	408.31	30.2	86.36		14:00	100.9	405.21	13.2	55.76
	15:00	101.64	408.19	30	86		15:00	100.88	405.13	13.2	55.76
	16:00	101.6	408.03	29.8	85.64		16:00	100.86	405.05	14.6	58.28
	17:00	101.51	407.66	30.3	86.54		17:00	100.86	405.05	15.6	60.08
	18:00	101.47	407.50	30.1	86.18		18:00	100.79	404.77	15.2	59.36
June 1/88	19:00	101.45	407.42	29	84.2		19:00	100.82	404.89	14.3	57.74
	20:00	101.43	407.34	27.6	81.68		20:00	100.9	405.21	14	57.2
	21:00	101.44	407.38	25.1	77.18		21:00	100.93	405.33	13.4	56.12
	5:00	-	-	17.1	62.78	June 8/88	5:00	-	-	9.6	49.28
	6:00	101.23	406.54	16.2	61.16		6:00	100.99	405.58	8.7	47.66
	7:00	101.18	406.34	18.1	64.58		7:00	101.06	405.86	10.6	51.08
	8:00	101.13	406.14	20.3	68.54		8:00	101.08	405.94	12.5	54.5
	9:00	101.08	405.94	23.2	73.76		9:00	101.09	405.98	13.1	55.58
	10:00	101	405.62	25.6	78.08		10:00	101.09	405.98	13.5	56.3
	11:00	100.94	405.37	26.8	80.24		11:00	101.09	405.98	13.1	55.58
	12:00	100.86	405.05	27	80.6		12:00	101.12	406.10	12.8	55.04
	13:00	100.82	404.89	27	80.6		13:00	101.03	405.74	12.9	55.22
	14:00	100.85	405.01	25.4	77.72		14:00	101.12	406.10	12.9	55.22
	15:00	100.78	404.73	27.2	80.96		15:00	101.14	406.18	11.3	52.34
	16:00	100.76	404.65	25.4	77.72		16:00	101.09	405.98	11	51.8
	17:00	100.79	404.77	24.4	75.92		17:00	101.11	406.06	11	51.8
June 1/88	18:00	100.89	405.17	21.3	70.34		18:00	101.09	405.98	10.8	51.44
	19:00	101.01	405.66	15.8	60.44		19:00	-	-	11.2	52.16
	20:00	101.08	405.94	15	59						
	21:00	101.18	406.34	14.1	57.38						

TABLE D1 - WEATHER SUMMARY

MAY 29/88 TO JUNE 4/88 (cont'd)

DATE	TIME	PRES. KPA	PRES. IN H2O	TEMP. DEGC	TEMP. DEGF
June 2/88	5:00	- -	- -	8.6	47.48
	6:00	101.65	408.23	7.8	46.04
	7:00	101.69	408.39	8.5	47.3
	8:00	101.7	408.43	9.4	48.92
	9:00	101.73	408.55	9.9	49.82
	10:00	101.74	408.59	10.4	50.72
	11:00	101.74	408.59	11.3	52.34
	12:00	101.74	408.59	12.4	54.32
	13:00	101.71	408.47	13.8	56.84
	14:00	101.65	408.23	14.1	57.38
	15:00	101.6	408.03	14.6	58.28
	16:00	101.56	407.86	15.6	60.08
	17:00	101.5	407.62	15.8	60.44
	18:00	101.44	407.38	16.2	61.16
	19:00	101.45	407.42	15	59
	20:00	101.49	407.58	13.6	56.48
	21:00	101.44	407.38	12.8	55.04
June 3/88	5:00	- -	- -	8.5	47.3
	6:00	101.38	407.14	8.1	46.58
	7:00	101.45	407.42	8.7	47.66
	8:00	101.49	407.58	10	50
	9:00	101.52	407.70	11.6	52.88
	10:00	101.54	407.78	12.2	53.96
	11:00	101.6	408.03	13.5	56.3
	12:00	101.61	408.07	13.7	56.66
	13:00	101.61	408.07	15.4	59.72
	14:00	101.55	407.82	16.1	60.98
	15:00	101.57	407.90	17.6	63.68
	16:00	101.56	407.86	17.2	62.96
	17:00	101.57	407.90	16.6	61.88
	18:00	101.59	407.99	16.5	61.7
June 4/88	19:00	101.65	408.23	14	57.2
	20:00	101.68	408.35	13	55.4
	21:00	101.69	408.39	12.7	54.86
	5:00	- -	- -	8.3	46.94
	6:00	101.84	408.99	6.7	44.06
	7:00	101.83	408.95	9.3	48.74
	8:00	101.85	409.03	13.6	56.48
	9:00	101.89	409.19	16.2	61.16
	10:00	101.9	409.23	17.7	63.86
	11:00	101.89	409.19	18.9	66.02
	12:00	101.87	409.11	19.7	67.46
	13:00	101.83	408.95	19.5	67.1
	14:00	101.77	408.71	19.9	67.82
	15:00	101.69	408.39	21	69.8
	16:00	101.65	408.23	22.6	72.68
	17:00	101.54	407.78	21.8	71.24
	18:00	101.51	407.66	21.6	70.88
	19:00	101.49	407.58	21	69.8
	20:00	101.48	407.54	20	68
	21:00	101.46	407.46	18	64.4

APPENDIX E

LANDFILL GAS UTILIZATION

SURVEY FORMS

LANDFILL GAS UTILIZATION SURVEY

NAME OF COMPANY: Hess Machinery

TYPE OF MANUFACTURING / SERVICE: Make steel moulds for block machines.

ADDRESS: 1262 Stone Church Rd. East

CONTACT: Gudrun Hess , Vice-President (416-575-4440)

DATE: 16/06/88

1) Current Energy Requirements (electricity , fuel/oil , gas):

- heats building with natural gas. (\$5000 per year)
- equipment runs off electricity.

2) Machinery / Uses (i) intermitent or continuous requirements:

(ii) equipment convertible to gas:

possibly a metal cutter.

3) Proposed or Future Energy Requirements (electricity/fuel/oil/gas):

only foreseen is heating.

4) Are You Interested In Utilizing A Low Grade / Low Volume Landfill Gas:

expressed interest if economically feasible.

5) Would You Be Interested In Assisting In The Cost Of Installation of a System:

Yes. If economically feasible.

6) When Would You Be In Need of the Above System:

7) Additional Comments: Was quite environmentally conscious.

8) Approximate Distance From Site: 40meters from west face of landfill.

LANDFILL GAS UTILIZATION SURVEY

NAME OF COMPANY: Quality Ready Mix

TYPE OF MANUFACTURING / SERVICE: Concrete mix plant.

ADDRESS: 583 Nebo Rd. , Hannon , Ontario

CONTACT: Mac McKinnon (416-679-6433)

DATE: 16/06/88

1) Current Energy Requirements (electricity , fuel/oil , gas):

- boiler ; gas fed.

- runs only in winter. (unable to obtain dollar value)

2) Machinery / Uses (i) intermitent or continuous requirements:

- boiler is used to heatsteam for aggregate mix plant.

(ii) equipment convertible to gas:

3) Proposed or Future Energy Requirements (electricity/fuel/oil/gas):

- nil.

4) Are You Interested In Utilizing A Low Grade / Low Volume Landfill Gas:

expressed interest if economically feasible.

5) Would You Be Interested In Assisting In The Cost Of Installation of a System:

Yes. If economically feasible.

6) When Would You Be In Need of the Above System:

7) Additional Comments:

8) Approximate Distance From Site: 1.8km west on Nebo from Stone Church Rd.

(approximately 2km from landfill).

LANDFILL GAS UTILIZATION SURVEY

NAME OF COMPANY: DOMGLAS INC.

TYPE OF MANUFACTURING / SERVICE: Machine shop / mould design and manufacture.

ADDRESS: 215 Hempstead , Hannon

CONTACT: Dermitt Lee (416-387-9486)

DATE: 16/06/88

1) Current Energy Requirements (electricity , fuel/oil , gas):

-natural gas for heating. (\$12,000 per year)

-electricity for machinery.

2) Machinery / Uses (i) intermitent. or continuous requirements:

-both.

(ii) equipment convertible to gas:

- no specific cited.

3) Proposed or Future Energy Requirements (electricity/fuel/oil/gas):

4) Are You Interested In Utilizing A Low Grade / Low Volume Landfill Gas:

expressed interest if economically feasible.

5) Would You Be Interested In Assisting In The Cost Of Installation of a System:

Yes. If economically feasible.

6) When Would You Be In Need of the Above System:.

7) Additional Comments: few obstructions to location.

8) Approximate Distance From Site: 600-700m: from west face of landfill.

LANDFILL GAS UTILIZATION SURVEY

NAME OF COMPANY: Walter's Welding

TYPE OF MANUFACTURING / SERVICE: Structural steel fabricating

ADDRESS: 1318 Rymal Rd.

CONTACT: Simon Kranendonk or Nick Koppelaar (416-388-7111).

DATE: 16/06/88

1) Current Energy Requirements (electricity , fuel/oil , gas):

- hydro for running machines.

- natural gas for heating. (\$10,000 per year)

2) Machinery / Uses (i) intermitent or continuous requirements:

(ii) equipment convertible to gas:

- nil.

3) Proposed or Future Energy Requirements (electricity/fuel/oil/gas):

4) Are You Interested In Utilizing A Low Grade / Low Volume Landfill Gas:

- would consider it if economically feasible.

5) Would You Be Interested In Assisting In The Cost Of Installation of a System:

- if economically feasible.

6) When Would You Be In Need of the Above System:

7) Additional Comments: owns adjacent building housing a packaging machine manufacturer

8) Approximate Distance From Site: located one km. west of site.

LANDFILL GAS UTILIZATION SURVEY

NAME OF COMPANY: Lancaster Sheet Metal

TYPE OF MANUFACTURING / SERVICE: Sheet metal fabricating.

ADDRESS: Hempstead Dr. , Hannon

CONTACT: Bob Graham (416-388-3800)

DATE: 16/06/88

1) Current Energy Requirements (electricity, fuel/oil, gas):

-natural gas for heating: (\$3500 per year)

-electricity for machinery.

2) Machinery / Uses (i) intermittent or continuous requirements:

-both.

(ii) equipment convertible to gas:

- no specific cited.

3) Proposed or Future Energy Requirements (electricity/fuel/oil/gas):

4) Are You Interested In Utilizing A Low Grade / Low Volume Landfill Gas?
expressed interest if economically feasible.

5) Would You Be Interested In Assisting In The Cost Of Installation of a System?
Yes. If economically feasible.

6) When Would You Be In Need of the Above System:

7) Additional Comments:

8) Approximate Distance From Site: 600-700m from west face of landfill.

LANDFILL GAS UTILIZATION SURVEY

NAME OF COMPANY: Hamilton Fire Dept.

TYPE OF MANUFACTURING / SERVICE: Training facility

ADDRESS: at base of northwest corner of site.

CONTACT: Deputy Chief J. Fitzpatrick (416-522-1155)

E: 16/06/88

Current Energy Requirements (electricity, fuel/oil, gas):
- pipe in some natural gas for training purposes (small amount).

Machinery / Uses (i) intermittent or continuous requirements:
(ii) equipment convertible to gas:

Used or Future Energy Requirements (electricity/fuel/oil/gas):

Interested In Utilizing A Low Grade / Low Volume Landfill Gas:
- foresaw no potential departmental use.

Be Interested In Assisting In The Cost Of Installation of a System:

You Be In Need of the Above System:

Comments: Contacted the Deputy Chief.

From Site: located at base of site (northwest corner).

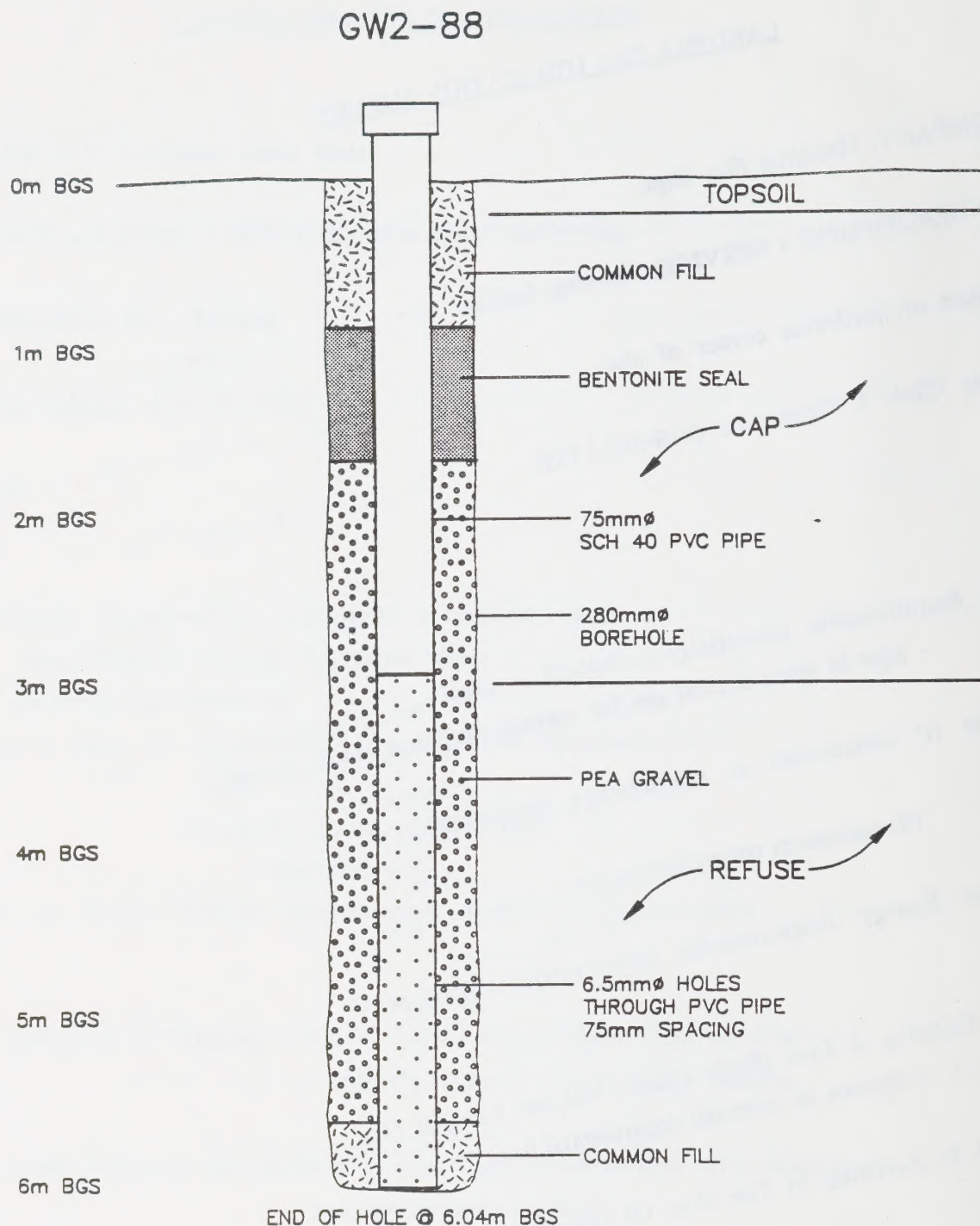


figure A.2

GW2-88

UPPER OTTAWA STREET LANDFILL GAS
Regional Municipality of Hamilton-Wentworth

CRA

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